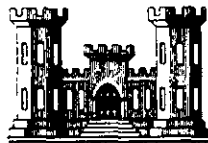


CONNECTICUT COASTAL BASIN
EAST HAVEN-BRANFORD, CONNECTICUT
LAKE SALTONSTALL DAM
CT 00115

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM



DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS. 02154

The original hardcopy version of this report
contains color photographs and/or drawings.
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please email

AUGUST, 1979

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
REPORT NUMBER CT 00115	2. GOVT ACCESSION NO. ADA 143064	3. RECIPIENT'S CATALOG NUMBER
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AUTHOR(s) S. ARMY CORPS OF ENGINEERS NEW ENGLAND DIVISION		6. PERFORMING ORG. REPORT NUMBER
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SUPPLEMENTARY NOTES Cover program reads: Phase I Inspection Report, National Dam Inspection Program; however, the official title of the program is: National Program for Inspection of Non-Federal Dams; use cover date for date of report.		
KEY WORDS (Continue on reverse side if necessary and identify by block number) DAMS, INSPECTION, DAM SAFETY, Conn. Coastal Basin East Haven-Branford, Conn. Lake Saltonstall Dam		
ABSTRACT (Continue on reverse side if necessary and identify by block number) The dam is an earthfill structure with an upstream masonry and concrete retaining wall. The top of the dam is approx. 80 ft. in width at the spillway and 20 ft. above the streambed of the Farm River Diversion. The top of the dam is approx. 100 ft. long along the upstream edge of the crest and approx. 200 ft. long along the downstream edge of the crest, as shown on sheet B-1. The test flood will be equivalent to the PMF. Peak inflow to the reservoir is 7450 cfs; peak outflow is 1000 cfs with the dam overtopped, 1.9 ft. Based on our hydraulic computations, the spillway capacity is 220 cfs.		
FORM 1472 EDITION OF NOVEMBER 1963		



DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02154

REPLY TO
ATTENTION OF:

NEDED

NOV 28 1979

Honorable Ella T. Grasso
Governor of the State of Connecticut
State Capitol
Hartford, Connecticut 06115

Dear Governor Grasso:

Inclosed is a copy of the Lake Saltonstall Dam Phase I Inspection Report, which was prepared under the National Program for Inspection of Non-Federal Dams. This report is presented for your use and is based upon a visual inspection, a review of the past performance and a brief hydrological study of the dam. A brief assessment is included at the beginning of the report. I have approved the report and support the findings and recommendations described in Section 7 and ask that you keep me informed of the actions taken to implement them. This follow-up action is a vitally important part of this program.

A copy of this report has been forwarded to the Department of Environmental Protection, the cooperating agency for the State of Connecticut. In addition, a copy of the report has also been furnished the owner, New Haven Water Company, New Haven, Connecticut 06511.

Copies of this report will be made available to the public, upon request, by this office under the Freedom of Information Act. In the case of this report the release date will be thirty days from the date of this letter.

I wish to take this opportunity to thank you and the Department of Environmental Protection for your cooperation in carrying out this program.

Sincerely,

A handwritten signature in dark ink, appearing to read "Max B. Scheider", is written over the typed name.

MAX B. SCHEIDER
Colonel, Corps of Engineers
Division Engineer

Incl
As stated

CONNECTICUT COASTAL BASIN
EAST HAVEN-BRANFORD, CONNECTICUT
LAKE SALTONSTALL DAM
CT 00115

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM



DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS. 02154

AUGUST, 1979

BRIEF ASSESSMENT

PHASE I INSPECTION REPORT

NATIONAL PROGRAM OF INSPECTION OF DAMS

Name of Dam:	LAKE SALTONSTALL DAM
Inventory Number:	CT-00115
State Located:	CONNECTICUT
County Located:	NEW HAVEN
Town Located:	EAST HAVEN-BRANFORD
Stream:	DIVERSION OF FARM RIVER
Owner:	NEW HAVEN WATER COMPANY
Date of Inspection:	MAY 2, 1979
Inspection Team:	PETER M. HEYNEN, P.E. CALVIN GOLDSMITH MIRON PETROVSKY GEORGE STEPHENS NORMAN PALUBA

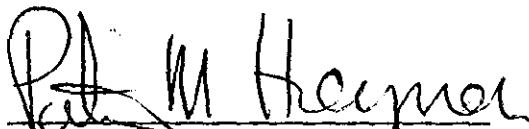
The dam is an earthfill structure with an upstream masonry and concrete retaining wall. The top of the dam is approximately 80 feet in width at the spillway and 20 feet above the streambed of the Farm River Diversion. The top of the dam is approximately 100 feet long along the upstream edge of the crest and approximately 200 feet long along the downstream edge of the crest, as shown on sheet B-1 in the appendix. U.S. Route 1, a four lane highway, runs along the top of the dam. The spillway consists of a 10 foot wide by 4.2 foot high opening in the upstream masonry wall for the enclosed concrete ogee weir which feeds a 36" x 58" corrugated metal arch culvert through the embankment. The arch culvert connects to a junction box, as does the 24 inch low level outlet pipe, which runs from a concrete intake chamber 10 feet upstream of the upstream face of the dam. A 48 inch reinforced concrete pipe discharges from the junction box to the downstream streambed at the toe of the dam.

Based upon the visual inspection at the site and past performance, the dam is judged to be in fair condition. No evidence of structural instability was observed, however surface sloughing and erosion of the downstream embankment slope was noted.

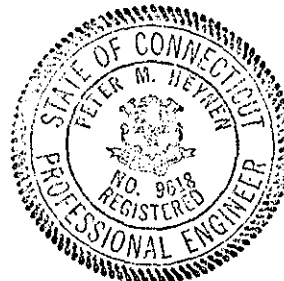
Based on the size (Intermediate) and hazard classification (High) of this dam determined in accordance with Corps of Engineers Guidelines, the test flood will be equivalent to the Probable Maximum Flood (PMF). Peak inflow to the reservoir is 7450 cfs; peak outflow is 1900 cfs with the dam overtopped 1.9 feet. Based on our hydraulic computations, the spillway capacity is 220 cfs, which is equivalent to 12% of the routed test flood outflow.

It is recommended that further studies by a qualified professional engineer be initiated by the owner to perform a more refined hydraulic/hydrologic study to determine the spillway capacity and overtopping potential. Recommendations should be made by the engineer and implemented by the owner to increase the project discharge based upon the refined hydraulic/hydrologic study.

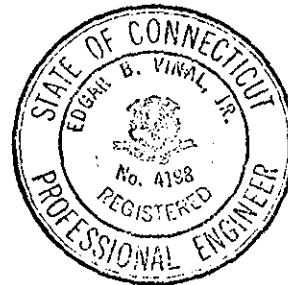
The above recommendations, and any required remedial measures, are discussed in Section 7 and should be instituted within 2 years of the owner's receipt of this report.



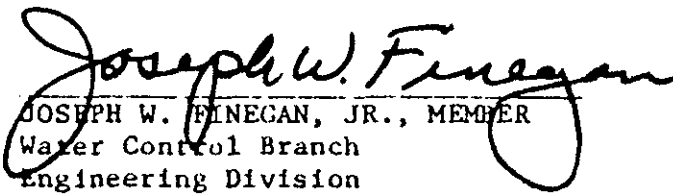
Peter M. Heynen, P.E.
Project Manager
Cahn Engineers, Inc.

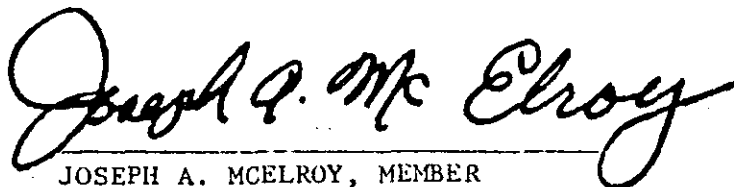


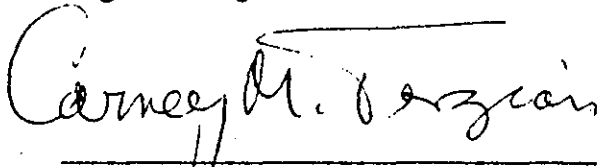
Edgar B. Vinal, Jr., P.E.
Senior Vice President
Cahn Engineers, Inc.



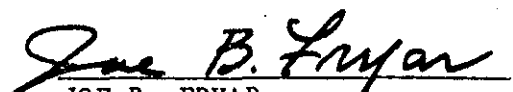
This Phase I Inspection Report on Lake Saltonstall Dam has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgment and practice, and is hereby submitted for approval.


JOSEPH W. FINEGAN, JR., MEMBER
Water Control Branch
Engineering Division


JOSEPH A. MCELROY, MEMBER
Foundation & Materials Branch
Engineering Division


CARNEY M. TERZIAN, CHAIRMAN
Chief, Structural Section
Design Branch
Engineering Division

APPROVAL RECOMMENDED:


JOE B. FRYAR
Chief, Engineering Division

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspection. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I Investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam would necessarily represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions will be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test Flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

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OVERVIEW PHOTO

US ARMY ENGINEER DIV. NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

CAHN ENGINEERS INC.
WALLINGFORD, CONN.
ENGINEER

NATIONAL PROGRAM OF
INSPECTION OF
NON-FED DAMS

LAKE SALTONSTALL DAM

TR. FARM RIVER

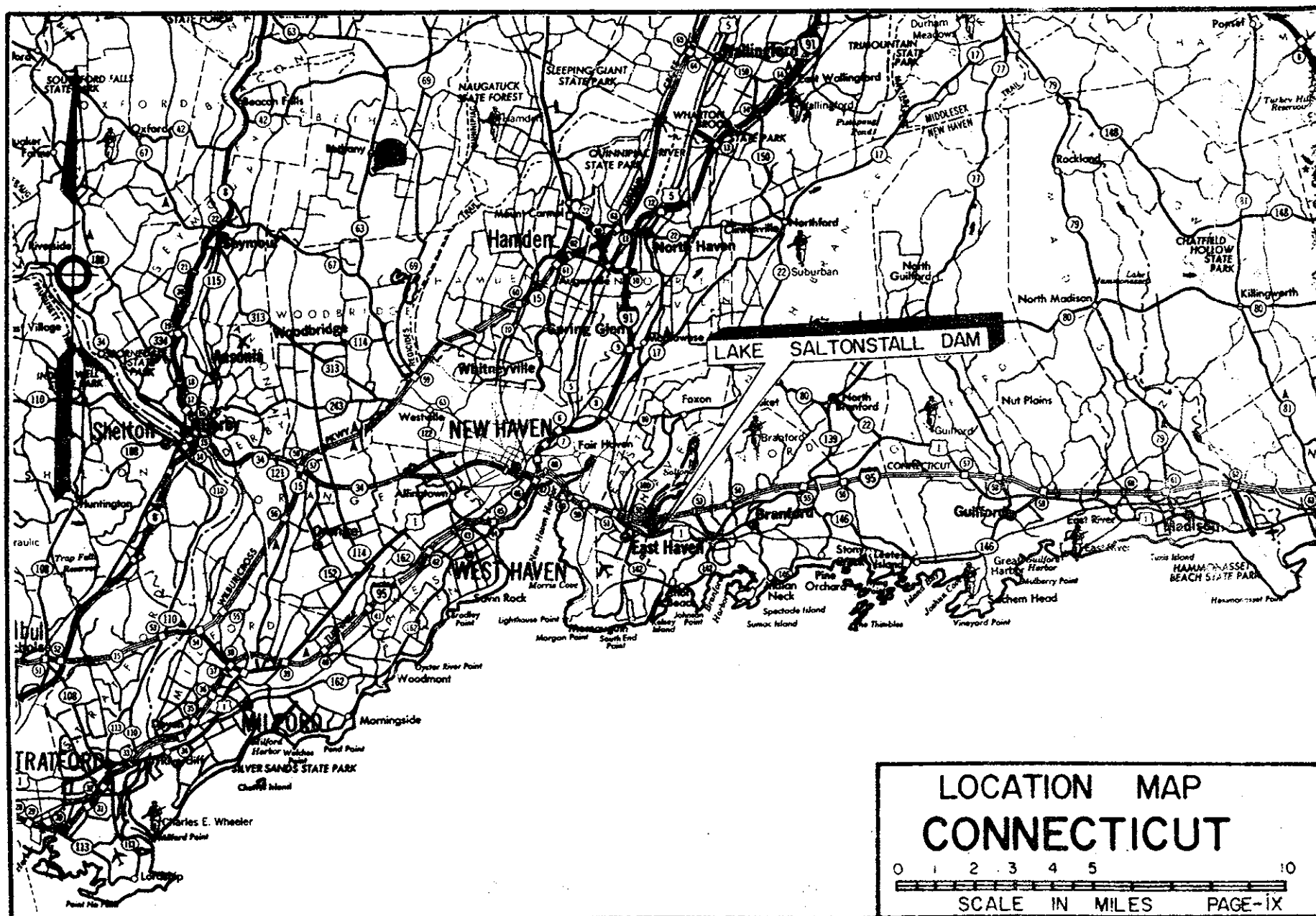
EAST HAVEN
BRANFORD

CONNECTICUT

DATE March '79

CE # 27 660 KA

PAGE viii



PHASE I INSPECTION REPORT

LAKE SALTONSTALL DAM

SECTION I - PROJECT INFORMATION

1.1 GENERAL

a. Authority - Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a National Program of Dam Inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. Cahn Engineers, Inc. has been retained by the New England Division to inspect and report on selected dams in the State of Connecticut. Authorization and notice to proceed were issued to Cahn Engineers, Inc. under a letter of March 30, 1979 from John P. Chandler, Colonel, Corps of Engineers. Contract No. DACW 33-79-3-0059 has been assigned by the Corps of Engineers for this work.

b. Purpose of Inspection Program - The purposes of the program are to:

1. Perform technical inspection and evaluation of non-federal dams to identify conditions requiring correction in a timely manner by non-federal interests.
2. Encourage and prepare the States to quickly initiate effective dam inspection programs for non-federal dams.
3. To update, verify and complete the National Inventory of Dams.

c. Scope of Inspection Program - The scope of this Phase I inspection report includes:

1. Gathering, reviewing and presenting all available data as can be obtained from the owners, previous owners, the state and other associated parties.
2. A field inspection of the facility detailing the visual condition of the dam, embankments and appurtenant structures.
3. Computations concerning the hydraulics and hydrology of the facility and its relationship to the calculated flood through the existing spillway.

4. An assessment of the condition of the facility and corrective measures required.

It should be noted that this report does not pass judgment on the safety or stability of the dam other than on a visual basis. The inspection is to identify those features of the dam which need corrective action and/or further study.

1.2 DESCRIPTION OF PROJECT

a. Location - The dam is located on a diversion of the Farm River in a suburban area of the Towns of Branford and East Haven, County of New Haven, State of Connecticut. The dam is shown on the Branford USGS Quadrangle map as having coordinates latitude N $41^{\circ} 16.9'$ and longitude W $72^{\circ} 51.7'$.

b. Description of Dam and Appurtenances - The earthfill dam is approximately 100 feet long at the upstream face and approximately 200 feet long at the downstream face, with a top width of approximately 80 feet at the spillway section. The dam was originally built wide enough to accommodate a two lane road along its crest. In 1928, the road was widened to 4 lanes, necessitating a widening of the crest of approximately 18 feet. Improvements to the 4 lane road in the early 1940's resulted in a widening of the crest of the dam to its present width which now accommodates the 4 lanes of U.S. Route 1. The upstream face of the dam is a vertical concrete and masonry wall in which the spillway is set. The spillway is a 10 foot long by 4.2 foot high concrete enclosed ogee section discharging to a 36 inch x 58 inch corrugated metal arch pipe culvert leading to a junction box in the downstream portion of the highway embankment. The low level outlet is a 24 inch cast iron pipe which also discharges to the junction box. A 48 inch diameter reinforced concrete culvert discharges to the streambed at the downstream toe of the dam from the junction box. The spillway crest is at elevation 22.1, 5 feet below the top of the dam, while the low level outlet intake is at elevation 13.3, 13.8 feet below the top of the dam. The ungated spillway has a bar screen across the intake to serve as a trash rack. The low level outlet is regulated by a hand operated gate on the concrete intake chamber 10 feet upstream of the dam.

The downstream face of the dam is an earth fill roadway embankment at an inclination of 2 horizontal to 1 vertical, and is somewhat protected against erosion by a growth of grass and weeds.

c. Size Classification - INTERMEDIATE - The dam impounds 6700 acre-feet of water with the level at the top of the dam, which at elevation 27.1, is 25⁺ feet above the stream bed. According to the Recommended Guidelines, this dam is classified as intermediate in size

d. Hazard Classification - HIGH - The dam is located immediately upstream (500 ft.) of 3 low lying houses and a trolley museum which would be in the path of a flood outflow caused by a breach of the dam. Further downstream about one mile after passing through some marshland, there is another urban area with at least 5 low lying houses along the Farm River near Short Beach Road.

e. Ownership - New Haven Water Co.
90 Sargent Drive
New Haven, Connecticut 06511
Mr. Jack Reynolds (203) 624-6671

f. Operator - Mr. James Creaser
New Haven Water Company
(203) 469-5309

g. Purpose of Dam - Public water supply

h. Design and Construction History - According to a plaque on the dam dated 1655, a dam on this site was used to provide power to Connecticut's third iron works plant. The exact date of construction of the dam in its present form is not known, however specifications for its construction are noted as being from 1882. Post-construction changes to the dam consisted primarily of changes in the width of the roadway across the dam. The two lane road was widened to a four lane road in 1928 which necessitated extending the low level outlet and spillway outlet pipes some 18 feet to clear the widened roadway embankment. The embankment was widened an undetermined amount again in the early 1940's to accommodate improvements of the 4 lane highway.

In 1949, the low level outlet valve at the upstream face of the dam was inoperable, and was replaced with the present gated concrete intake chamber approximately 10 feet upstream of the dam.

In 1960, the present concrete spillway was constructed, and the 36 inch by 58 inch corrugated metal arch pipe was constructed under the highway to replace the two smaller pipes which previously carried the spillway flow but collapsed in May 1, 1959. A junction box was installed in the embankment to route flow from the spillway culvert and the low level outlet pipe to a 48 inch reinforced concrete discharge pipe. At this time, the upstream masonry facing of the dam was raised with concrete 2 feet to its present elevation.

i. Normal Operational Procedures - The low level outlet valve is normally opened about 40 turns of a possible 200 to keep water flowing in Furnace Pond, that part of Lake Saltonstall immediately upstream of the dam. The filtration plant for the public water supply is located upstream of the dam on the west shore of Lake Saltonstall, and draws water from the reservoir as needed.

1.3 PERTINENT DATA

a. Drainage Area - 3.92 square miles of rolling terrain.

b. Discharge at Damsite - Discharge is through a 24 inch low level outlet, and through a 58" x 36" metal arch culvert downstream of the concrete spillway weir. It is conceivable that discharge through the outlet conduit could be somewhat reduced by unusually high tide conditions during large storms.

- | | |
|---|---|
| 1. Outlet Works: | 24 inch low level outlet at Invert
Elevation 8.4 - Invert of concrete intake
Elevation 13.3 |
| | Spillway conduit 58" by 36" corrugated metal arch pipe culvert at Invert
Elevation 17.4 |
| 2. Maximum known flood at damsite: | Unknown |
| 3. Ungated spillway capacity @ top of dam elevation 27.1: | 220 cfs. |
| 4. Ungated spillway capacity @ test flood elevation: | N/A |
| 5. Gated spillway capacity @ normal pool elevation: | N/A |
| 6. Gated spillway capacity @ test flood elevation: | N/A |
| 7. Total spillway capacity @ test flood elevation: | N/A |
| 8. Total project discharge @ test flood elevation 29.0: | 1900 cfs. |
- c. Elevations - (Feet Above Mean Sea Level = MHW +2.83)
- | | |
|---|--------------------------------|
| 1. Streambed at centerline of dam: | 2 ⁺ |
| 2. Maximum tailwater: | N/A |
| 3. Upstream portal invert diversion tunnel: | N/A-Tunnel discharges to canal |
| 4. Recreation pool: | N/A |

- | | |
|---|------|
| 5. Full flood control pool: | N/A |
| 6. Spillway crest: | 22.1 |
| 7. Design surcharge
(original design): | N/A |
| 8. Top of dam: | 27.1 |
| 9. Test flood design surcharge: | 29.0 |
- d. Reservoir
- | | |
|----------------------------------|-----------------|
| 1. Length of maximum pool: | Approx. 5 miles |
| 2. Length of recreation pool: | N/A |
| 3. Length of flood control pool: | N/A |
- e. Storage
- | | |
|-------------------------|----------------------------|
| 1. Recreation pool: | N/A |
| 2. Flood control pool: | N/A |
| 3. Spillway crest pool: | 4700 acre - ft. |
| 4. Top of dam: | 6900 acre-ft. |
| 5. Test flood pool: | 7700 ₊ acre-ft. |
- f. Reservoir Surface
- | | |
|------------------------|------------|
| 1. Recreation pool: | N/A |
| 2. Flood control pool: | N/A |
| 3. Spillway crest: | 388 acres |
| 4. Test flood pool: | 430+ acres |
| 5. Top of dam: | 430 acres |
- g. Dam
- | | |
|---------------|--|
| 1. Type: | Earthfill with up-
stream masonry and
concrete face |
| 2. Length: | 100 ⁺ ft. upstream
200 ⁺ ft. downstream |
| 3. Height: | 25 ⁺ ft. |
| 4. Top width: | 80 ⁺ ft. at spillway |

- | | |
|---------------------|---|
| 5. Side slopes: | Vertical (Upstream)
2H to 1 V (Downstream) |
| 6. Zoning: | N/A |
| 7. Impervious Core: | N/A |
| 8. Cutoff: | Not known |
| 9. Grout curtain: | N/A |
| 10. Other: | N/A |
- h. Diversion and Regulating Tunnel
- | | |
|---------------------------|---|
| 1. Type: | Diversion tunnel unlined in rock, otherwise concrete and brick conduit-discharges to a canal leading to Lake Salton-stall. Minimum Diameter 5". |
| 2. Length: | 2000 [±] ft. |
| 3. Closure: | N/A |
| 4. Access: | N/A |
| 5. Regulating Facilities: | Gated at upstream tunnel entrance |
- i. Spillway
- | | |
|------------------------|--|
| 1. Type: | Concrete ogee weir to 58" to 36" culvert |
| 2. Length of weir: | 10 ft. |
| 3. Crest elevation: | 22.1 |
| 4. Gates: | None |
| 5. Upstream Channel: | 8' deep maximum
Vertical dam face |
| 6. Downstream Channel: | Natural streambed |
| 7. General: | 58" x 36" arch culvert discharges to 48 inch pipe at junction box in embankment. |

j. Regulating Outlets

- | | |
|-----------------------|--|
| 1. Invert: | Intake chamber opening
el. 13.3; 24" pipe invert
el. 8.4 |
| 2. Size: | 24 inch diameter |
| 3. Description: | Cast iron pipe |
| 4. Control Mechanism: | Hand wheel lift |
| 5. Other: | Intake in concrete
chamber 10' upstream
of dam. |

SECTION 2: ENGINEERING DATA

2.1 DESIGN

a. Available Data - The available data consists of correspondence from New Haven Water Company and State of Connecticut personnel, and deals primarily with the dam in conjunction with the roadway. A publication concerning the Lake Saltonstall Tunnel diversion written by Edward E. Minor was also obtained, as well as other assorted pieces of data from the owner and the State of Connecticut.

b. Design Features - The available data indicates the design features stated herein.

c. Design Data - There were no engineering values, assumptions, test results or calculations available for the original construction. Information was available pertaining to the redesign of the spillway in 1959, and is included in Appendix B.

2.2 CONSTRUCTION

a. Available Data - No information is available on the actual construction of the dam itself, however as-built drawings for the outlet works are available, and as-built drawings encompassing the dam are available for the present configuration of U.S. Route 1 (See List of Existing Plans, Appendix B).

b. Construction Considerations - No information was available other than the above-mentioned as-built drawings obtained from the owner and the State of Connecticut Highway Department.

2.3 OPERATIONS

Lake level readings are taken daily. To our knowledge, the dam has not been overtopped. No other formal operations records are known to exist.

2.4 EVALUATION

a. Availability - Existing data was provided by the owner, and by the State of Connecticut. The owner made the facility available for visual inspection.

b. Adequacy - The limited amount of detailed engineering data available was generally inadequate to perform an in-depth assessment of the dam, therefore, this assessment of the dam must be based primarily on visual inspection, performance history, hydraulic computations and approximate hydrologic judgements.

c. Validity - A comparison of record data and visual observations reveals no observable significant discrepancies in the record data.

SECTION 3: VISUAL INSPECTION

3.1 FINDINGS

a. General - The general condition of the dam is fair. Inspection revealed some areas requiring maintenance and attention. The reservoir level was at elevation 22.2, 4.9 feet below the top of the dam at the time of our inspection, and the weather was sunny, warm and dry.

b. Dam

Crest - The crest of the earthfill dam accomodates U.S. Highway 1 (Photo 1). No misalignment of the crest was observed. Several cracks across the top were noted in the highway pavement which were most likely formed due to traffic loads.

Upstream Face - The upstream face of the dam is a 2 foot wide and 60+ foot long masonry stone wall with cement mortar joints. The wall has a 2 foot wide and 2 foot high new concrete cap which was installed in 1960. The facing generally is in good condition. However, there were observed open joints in the left side of the wall, cracking in the mortar, and separating of distinct stones with 1/2 to 1 inch wide cracks between them near the water level (Photo 2). Several vertical 1/16 to 1/8 inch wide cracks were discovered in the corners of the concrete cap.

Downstream Slope - The downstream earth slope of the dam with an inclination of approximately 2 horizontal to 1 vertical is covered with tall grass and some brush. Two erosion ditches up to 1 to 2 foot deep and 2 to 3 feet wide were observed along the left side of the downstream slope at a distance of 30+ and 60+ feet from the concrete outlet, respectively (Photo 5). Because of the absence of a barrier, the downstream slope has numerous signs of trespassing, as well.

Very slight seepage spots were revealed on the downstream toe near the right side at a distance of 10 to 20 feet from the concrete culvert outlet. A substantial wet area on the heavy grass cover is located below the seepage spots. A small flow leads from the wet area to the outlet channel. The formation of this wet area could be caused due to seepage both through the dam foundation and the surrounding downstream area.

Spillway - The new cast-in-place reinforced concrete spillway built in 1960 has a 10 foot by 4.2 foot opening with a bar screen trash rack with bars spaced approximately every 2 inches (Photo 3). There was flow over the spillway during the inspection and hence it could not be observed completely. Spalling and cracking of the concrete were noted on the left side of the spillway and at the right headwall adjacent to the spillway (Photo 3). Due to the location of the deteriorated concrete, it appears that the damage was caused by freeze-thaw cycles.

c. Appurtenant Structures - The spillway discharge outlet culvert is a 36 inch by 58 inch arch corrugated metal pipe installed under the highway in 1960. The conduit could not be examined

The concrete intake chamber is a concrete wet well with an intake opening to the 24 inch low level outlet pipe, which is connected to the junction box in the downstream portion of the highway embankment. There is a wooden plank service bridge between the chamber and the upstream face of the dam (Photo 2). At the downstream toe, there is a concrete low level outlet headwall, which exhibits deterioration of concrete particularly on the outlet wingwalls. This deterioration includes exposed aggregate, spalling, and a loss of the design shape due to the erosion of the wingwalls (Photo 5).

d. Reservoir Area - The reservoir area is bordered on the north and the northeast by a ridge. The area surrounding the reservoir is wooded and undeveloped, except at the south end along U.S. Route 1. The reservoir has an inlet diversion aqueduct from a tunnel from the Farm River, which enters the lake at the extreme north end.

Upstream of the dam, a railroad embankment crosses the lake and acts as a constriction through which water from the upstream portion of the lake must pass to reach the dam (Photo 4). The culvert through the embankment is a semi-circular arch with a 5' radius.

e. Downstream Channel - The downstream channel itself is in a fairly natural condition with a gravel and boulder bottom and trees and brush on its banks (Photo 6).

3.2 EVALUATION

Based upon the visual inspection, it was possible to assess the dam as being generally in fair condition.

The following features which could influence the future condition and/or stability of the dam were identified.

1. Concrete of the spillway, low level outlet service bridge abutment, the upstream stone masonry and concrete facing, and the downstream concrete headwall and wingwalls, is cracked and spalled, and will deteriorate more rapidly in the future if not repaired.
2. Downstream slope erosion will also increase with time, and will lead to gradual undermining of the roadway.
3. The seepage at the toe of the dam could develop into problem seepage in the future if not corrected or monitored.
4. The trash rack in front of the spillway opening would be blocked very easily by floating debris, because the bars are spaced only 2 inches on center.

SECTION 4: OPERATIONAL PROCEDURES

4.1 REGULATORY PROCEDURES

Lake level readings are taken daily. The 24 inch low level outlet is normally opened about 40 turns of a possible 200⁺ to maintain the flow of water in the stream and in the lake upstream of the dam. The filtration plant for the public water supply draws water from the reservoir from upstream of the dam as needed.

4.2 MAINTENANCE OF DAM

Little maintenance was evident on that portion of the dam downstream of U.S. Route 1. Traprock had been placed on the downstream slope where sloughing had occurred. The road along the crest is maintained by the State of Connecticut. The upstream face of the dam has some deterioration of the masonry and concrete, but otherwise appears to be fairly well maintained.

The New Haven Water Company three years ago instituted a yearly inspection program encompassing all their dams. The inspections are performed by a consultant qualified in the field of dam inspection.

4.3 MAINTENANCE OF OPERATING FACILITIES

The low level outlet valve was well greased and appeared to be well-maintained. The owner removes debris from the spillway bar screen periodically.

4.4 DESCRIPTION OF ANY FORMAL WARNING SYSTEM IN EFFECT

No formal warning system exists for this dam.

4.5 EVALUATION

The operational and maintenance procedures are generally fair. The downstream face of the dam should be maintained regularly.

A formal program of operation and maintenance procedures should be implemented, including documentation to provide complete records for future reference. Also, a formal warning system should be developed and implemented within the frame indicated in Section 7.1c. Remedial operation and maintenance recommendations are presented in Section 7.

SECTION 5: HYDRAULIC/HYDROLOGIC

5.1 EVALUATION OF FEATURES

a. General - Lake Saltonstall Dam and reservoir is generally a high storage - low spillage water supply facility.

The Lake Saltonstall watershed includes a tunnel diversion from the Farm River drainage area, which can be controlled by gates at the tunnel inlet, according to the New Haven Water Company. During large storms, the diversion tunnel inflow to Lake Saltonstall could be eliminated, and therefore it will not be considered as contributing to the peak inflow for the purposes of our computations.

Approximately 0.3 miles upstream of the dam, Lake Saltonstall is crossed by a railroad embankment with a stone masonry culvert. This crossing divides the lake's watershed and restricts flow from the upper, major portion of the lake to the lower portion and the dam. The embankment will significantly restrict the peak inflow to the dam. However, this is a man-made structure, and its ability to withstand a differential head is unknown, and as the embankment could be removed at any time, our analysis will assume the embankment to have been removed. The performance of Lake Saltonstall Dam at Test Flood conditions was analyzed without the attenuating effect of the railroad embankment.

b. Design Data - Information was available pertaining to the redesign of the spillway and discharge conduit in 1959. A letter dated September 11, 1959 by John J. Mozzochi and Associates to the State of Connecticut reviewed the sizing of the spillway as it presently exists based upon two different analyses of the hydrology of the project. A subsequent letter from John J. Mozzochi and Associates dated January 11, 1960 documents a meeting with the New Haven Water Company and their consultant, Clarence Blair and Associates, during which the New Haven Water Company agreed to raise the proposed top of the dam one foot to elevation 27.1 to provide 2 feet rather than only one foot of freeboard for the design storm. This correspondence is included in Appendix B.

c. Experience Data - In May of 1959, it was discovered that the outlet pipes under the roadway had been crushed and blocked completely by the settling embankment fill, which resulted in a 4 foot deep hole under the highway pavement. This situation precipitated the new spillway design and subsequent construction in 1960. The dam has reportedly not been overtopped, at least since the construction of the new spillway.

d. Visual Observations - The bar screen and the enclosed spillway weir and conduit configuration could be easily subject to blockage.

Further, more severe sloughing of the downstream slope in the vicinity of the discharge conduit could result in partial or complete obstruction of the outlet works.

e. Test Flood Analysis - The test flood for this high hazard, intermediate size dam is equivalent to the Probable Maximum Flood (PMF). Based upon "Preliminary Guidance for Estimating Maximum Probable Discharge", dated March, 1978, peak inflow to the reservoir is 7450 cfs (Appendix "D-3"); peak outflow is 1900 cfs with the dam overtopped 1.9 feet (Appendix "D-13"). Based upon our hydraulics computations, the spillway capacity is 220 cfs, which is approximately 12% of the routed Test Flood outflow at the top of dam, elevation 27.1.

f. Dam Failure Analysis - Utilizing the April, 1978, "Rule of Thumb Guidance for Estimating Downstream Dam Failure Hydrographs", the peak failure outflow from the dam breaching would be 12,000 cfs. At the 3 low lying houses in the initial impact area, a breach of the dam would result in flooding due to a rise in the water level of 8.7 feet, which corresponds to an increase in the water level from a depth of approximately 2.3 feet just before the breach to a depth of 11.0 feet just after the breach. Impact areas further downstream would be reached by flows which could be somewhat retarded by a railroad embankment downstream of the initial impact area.

SECTION 6: STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

a. Visual Observation - The visual inspection did not disclose any indications of structural stability problems. There was cracking and spalling of the concrete spillway, service bridge abutment, masonry wall cap and low level outlet headwall and wingwalls. There were also several substantial cracks in the upstream stone masonry facing, and substantial erosion on the downstream slope of the dam, as described in Section 3.

b. Design and Construction Data - The design and construction data is not sufficient to permit an in-depth analysis of the stability of the dam.

c. Operating Records - The operation records do not include any indications of dam instability from its construction around 1882 and subsequent modifications in 1949, and up to 1959. It was in 1959 that the spillway discharge culvert collapsed partially, causing a 4 foot deep hole in the highway pavement. The culvert was subsequently replaced with the existing arch culvert.

d. Post Construction Changes - The widening of the roadway along the top of the dam in 1928, and in the early 1940's resulted in the widening of the dam embankment, which would tend to increase the stability of the dam, provided the material used to construct the additional embankment width adjacent to the downstream face of the dam is more pervious than the material used to construct the original embankment. The nature of the materials used in the original construction and the subsequent additions was not determined, therefore the actual effect on the stability of the dam cannot be ascertained.

Reconstruction of the intake for the 24 inch low level outlet and the redesign of the spillway in 1949 and 1960, respectively, would tend to provide the increases in dam stability normally associated with improved outlet capacity.

The raising of the masonry upstream facing with concrete in 1960 is not sufficient to appreciably lessen the dam stability, and actually will serve to indirectly increase the dam stability by increasing the freeboard and decreasing the chances of overtopping of the dam during storms.

e. Seismic Stability - The dam is in Seismic Zone 1, and according to the Recommended Guidelines, need not be evaluated for seismic stability.

SECTION 7: ASSESSMENT, RECOMMENDATIONS AND REMEDIAL MEASURES

7.1 DAM ASSESSMENT

a. Condition - Based upon the visual inspection of the site and its past performance, the dam appears to be in fair condition. No evidence of structural instability was observed in the dam or its appurtenances. The embankment is generally in fair condition with areas of erosion on the downstream slope. Other areas requiring attention include the project discharge capacity and the maintenance problems. More detailed recommendations and remedial measures are presented in Section 7.2 and 7.3, respectively.

Based upon "Preliminary Guidance for Estimating Maximum Probable Discharge" dated March, 1978, peak inflow to the reservoir is 7450 cubic feet per second; peak outflow is 1900 cubic feet per second with the dam overtopped 1.9 feet. Based upon our hydraulics computations, the spillway capacity is 220 cubic feet per second, which is equivalent to approximately 12% of the routed Test Flood outflow.

b. Adequacy of Information - The information available is such that an assessment of the condition and stability of the dam must be based solely on visual inspection, past performance of the dam, and sound engineering judgement.

c. Urgency - It is recommended that the measures presented in Section 7.2 and 7.3 be implemented within one year of the owner's receipt of this report.

d. Need for Additional Information - There is a need for more information as recommended in Section 7.2.

7.2 RECOMMENDATIONS

1. Based upon the computations in Appendix "D", the dam spillway capacity will be exceeded by the Test Flood. More sophisticated flood routing should be undertaken by hydrologists/hydraulics engineers to refine the spillway design flood figures. A study should be undertaken to determine the spillway capacity and potential for overtopping. Recommendations should be made by the engineer and implemented by the owner to increase the project discharge capacity based upon the refined spillway design flood figures.

7.3 REMEDIAL MEASURES

a. Operation and Maintenance Procedures - The following measures should be undertaken within the time frame indicated in Section 7.1c, and continued on a regular basis.

1. Round-the-clock surveillance should be provided by the owner during periods of unusually heavy precipitation. The owner should develop a formal warning system with local officials for alerting downstream residents in case of an emergency.

2. A formal program of operations and maintenance procedures should be instituted and fully documented to provide accurate records for future reference.

3. The New Haven Water Company has instituted a yearly program of technical inspection of all their dams, including Lake Saltonstall Dam, by an engineer qualified in the field of dam inspection. This program, which has been in effect for 3 years, should be continued and should include the operation of all outlet facilities.

4. The relatively minor cracking and spalling of the concrete of the spillway, service bridge abutment and outlet retaining wall, as well as the cracks in the stone masonry facing, should be repaired.

5. Sloughing of the downstream slope should be repaired and appropriate measures taken to prevent further slope failures. Consideration should be given to the installation of a fence around the downstream slope and toe of the dam to prevent trespassing which has caused erosion problems on the downstream slope. Cutting of grass of the downstream slope and the toe should be performed regularly as part of the routine dam maintenance.

6. The area of seepage at the downstream toe near the right side of the dam should be monitored periodically for increases in seepage flow.

7. The gates at the inlet to the diversion tunnel from the Farm River should be closed as part of the formal operational procedures to be followed during major storms.

8. Consideration should be given to installing a log boom upstream of the spillway inlet to minimize blockage of the spillway outlet. Also, consideration should be given to increasing the spacing of the trash rack bars so as to minimize the chances of blockage.

7.4 ALTERNATIVES

This study has identified no practical alternatives to the above recommendations.

APPENDIX A

INSPECTION CHECKLIST

VISUAL INSPECTION CHECK LIST
PARTY ORGANIZATION

PROJECT Lake Saltonstall Dam

DATE: May 2, 1979

TIME: 11:00 AM

WEATHER: SUNNY, 70°F

W.S. ELEV. 22.2 U.S. _____ DN.S

PARTY:

INITIALS:

DISCIPLINE:

1. <u>Peter M. Heyner</u>	<u>PMH</u>	<u>CAHN ENGINEERS, INC.</u>
2. <u>CALVIN GOLDSMITH</u>	<u>CG</u>	<u>CAHN ENGINEERS, INC.</u>
3. <u>MIRON PETROVSKY</u>	<u>MP</u>	<u>CAHN ENGINEERS, INC.</u>
4. <u>GEORGE STEPHENS</u>	<u>GS</u>	<u>CAHN ENGINEERS, INC.</u>
5. <u>NORMAN PALUBA</u>	<u>NP</u>	<u>NEW HAVEN WATER CO.</u>
6. _____	_____	_____

PROJECT FEATURE

INSPECTED BY

REMARKS

1. <u>EARTH DAM EMBANKMENT</u>	<u>PMH, CG, MP</u>	
2. <u>CONCRETE INTAKE CHAMBER</u>	<u>PMH, CG, MP, GS, NP</u>	
3. <u>CONCRETE SPILLWAY</u>	<u>PMH, CG, MP, GS</u>	
4. <u>CONCRETE OUTLET HEADWALL</u>	<u>PMH, MP</u>	
5. _____	_____	
6. _____	_____	
7. _____	_____	
8. _____	_____	
9. _____	_____	
10. _____	_____	
11. _____	_____	
12. _____	_____	

PERIODIC INSPECTION CHECK LIST

Page A-2PROJECT LAKE SALTONSTALL DAMDATE MAY 2, 1979PROJECT FEATURE EARTH DAM EMBANKMENT BY PMH, CG, MP

AREA EVALUATED	CONDITION
<u>EMBANKMENT</u>	
Crest Elevation	27.1
Current Pool Elevation	22.2 ±
Maximum Impoundment to Date	NOT KNOWN
Surface Cracks	NONE OBSERVED
Avement Condition	Good, SOME CRACKING
ovement or Settlement of Crest	NONE OBSERVED
ateral Movement	NONE OBSERVED
ertical Alignment	NONE OBSERVED
orizontal Alignment	NONE OBSERVED
ondition at Abutment and at Concrete structures	Good
ndications of Movement of Structural items on Slopes	NONE OBSERVED
trespassing on Slopes	FOOTPATHS
loughing or Erosion of Slopes or Abutments	MAJOR EROSION of D/S SLOPE
ock Slope Protection-Riprap Failures	CRACKING & SPALLING of U/S CONCRETE AND MASONRY WALL
Unusual Movement or Cracking at or near Toes	NONE OBSERVED
Unusual Embankment or Downstream Seepage	Slight seepage AND WET AREA AT RIGHT SIDE OF TOE
Piping or Boils	NONE OBSERVED
Foundation Drainage Features	
Toe Drains	} N/A
Instrumentation System	

PERIODIC INSPECTION CHECK LIST

Page A-3

PROJECT LAKE SALTONSTALL DAM

DATE MAY 2, 1979

PROJECT FEATURE CONCRETE INTAKE CHAMBER BY PMH, CB, MP, GS, NP

AREA EVALUATED	CONDITION
<u>OUTLET WORKS-CONTROL TOWER</u>	
1) <u>Concrete and Structural</u>	
General Condition	Good
Condition of Joints	
Spalling	
Visible Reinforcing	
Rusting or Staining of Concrete	
Any Seepage or Efflorescence	
Joint Alignment	
Unusual Seepage or Leaks in Gate Chamber	
Cracks	
Rusting or Corrosion of Steel	
2) <u>Mechanical and Electrical</u>	
Air Vents	N/A
Float Wells	
Crane Hoist	
Elevator	
Hydraulic System	
Service Gates	24" GATE VALVE OPERATED by HAND WHEEL
Emergency Gates	
Lightning Protection System	N/A
Emergency Power System	
Wiring and Lighting System	

A-3

A-5

PERIODIC INSPECTION CHECK LIST

Page A-3

PROJECT LAKE SALTON STALL DAM

DATE MAY 2, 1979

PROJECT FEATURE CONCRETE INTAKE CHAMBER BY PMH, CB, MP, GS, NP

AREA EVALUATED	CONDITION
<u>OUTLET WORKS-CONTROL TOWER</u>	
1) <u>Concrete and Structural</u>	
General Condition	Good NONE OBSERVED
Condition of Joints	
Spalling	
Visible Reinforcing	
Rusting or Staining of Concrete	
Any Seepage or Efflorescence	
Joint Alignment	
Unusual Seepage or Leaks in Gate Chamber	
Cracks	
Rusting or Corrosion of Steel	
2) <u>Mechanical and Electrical</u>	
Air Vents	N/A
Float Wells	
Crane Hoist	
Elevator	
Hydraulic System	
Service Gates	24" GATE VALVE OPERATED by HAND WHEEL
Emergency Gates	
Lightning Protection System	N/A
Emergency Power System	
Wiring and Lighting System	

PERIODIC INSPECTION CHECK LIST

Page A-4

PROJECT LAKE SALTONSTALL DAM

DATE MAY 2, 1979

PROJECT FEATURE CONCRETE OUTLET HEADWALL

BY PMH, MP

AREA EVALUATED	CONDITION
<u>TIET WORKS-OUTLET STRUCTURE AND</u> <u>OUTLET CHANNEL</u>	
neral Condition of Concrete	POOR
st or Staining	NONE OBSERVED
alling	SOME CRACKING AND SPALLING
osion or Cavitation	EROSION OF WING WALLS WITH EXPOSED AGGREGATE AND LOSS OF DESIGN SHAPE
sible Reinforcing	} NONE OBSERVED
y Seepage or Efflorescence	
ndition at Joints	
ain Holes	
annel	} NONE OBSERVED
Loose Rock or Trees Overhanging Channel	
Condition of Discharge Channel	GOOD

PERIODIC INSPECTION CHECK LIST

Page A-5

PROJECT LAKE SALTONSTALL DAM

DATE MAY 2, 1979

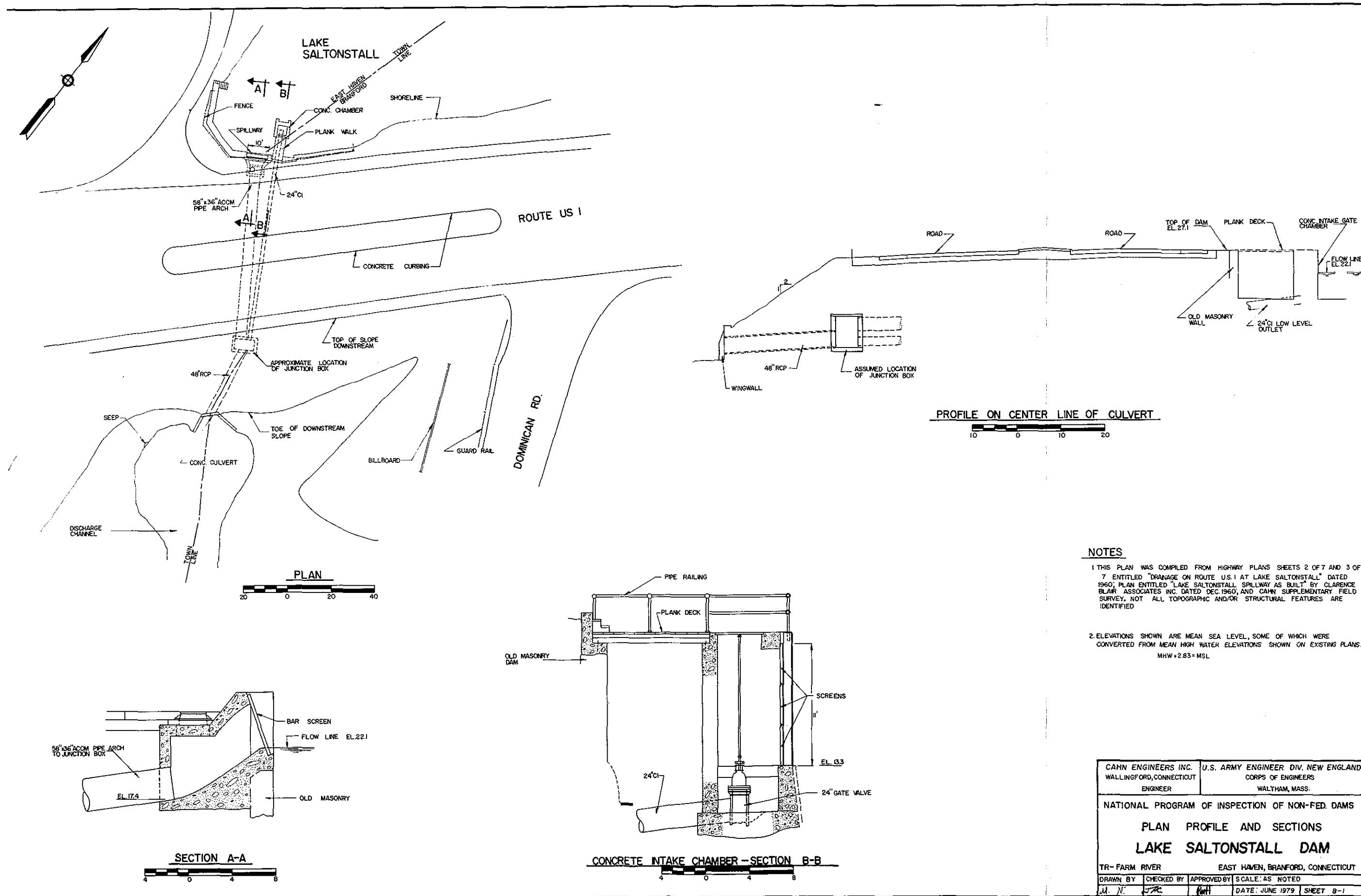
PROJECT FEATURE CONCRETE SPILLWAY

BY PMH, CG, MP, GS

AREA EVALUATED	CONDITION
<u>TLET WORKS-SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS</u>	
<u>Approach Channel</u>	
General Condition	} NOT KNOWN
Loose Rock Overhanging Channel	
Trees Overhanging Channel	
Floor of Approach Channel	
<u>Weir and Training Walls</u>	
General Condition of Concrete	GOOD
Rust or Staining	NONE OBSERVED
Spalling	SOME DETERIORATION NEAR WATER LEVEL
Any Visible Reinforcing	} NONE OBSERVED
Any Seepage of Efflorescence	
Drain Holes	N/A
) <u>Discharge Channel</u>	
General Condition	GOOD
Loose Rock Overhanging Channel	NONE OBSERVED
Trees Overhanging Channel	SOME TREES
Floor of Channel	SOME SILTY SAND, GRAVEL & STONE
Other Obstructions	

APPENDIX B

ENGINEERING DATA AND CORRESPONDENCE



NOTES

1. THIS PLAN WAS COMPILED FROM HIGHWAY PLANS SHEETS 2 OF 7 AND 3 OF 7 ENTITLED "DRAINAGE ON ROUTE U.S. 1 AT LAKE SALTONSTALL" DATED 1960; PLAN ENTITLED "LAKE SALTONSTALL SPILLWAY AS BUILT" BY CLARENCE BLAIR ASSOCIATES INC. DATED DEC. 1960; AND CAHN SUPPLEMENTARY FIELD SURVEY. NOT ALL TOPOGRAPHIC AND/OR STRUCTURAL FEATURES ARE IDENTIFIED.

2. ELEVATIONS SHOWN ARE MEAN SEA LEVEL, SOME OF WHICH WERE CONVERTED FROM MEAN HIGH WATER ELEVATIONS SHOWN ON EXISTING PLANS. MHW + 2.83 = MSL.

CAHN ENGINEERS INC. WALLINGFORD, CONNECTICUT ENGINEER	U.S. ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.		
NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS			
PLAN PROFILE AND SECTIONS			
LAKE SALTONSTALL DAM			
TR- FARM RIVER	EAST HAVEN, BRANFORD, CONNECTICUT		
DRAWN BY	CHECKED BY	APPROVED BY	SCALE: AS NOTED
M. N.	JAL	PHH	DATE: JUNE 1979 SHEET 8-1

LAKE SALTONSTALL DAM
LIST OF EXISTING PLANS

"Plan Showing Land to be Acquired From New Haven
Water Co. By The State of Connecticut,
Intersection of Routes 1 and 1A."
William J. Cox, Highway Commissioner
July, 1941

"Lake Saltonstall Drainage Improvement,
Design #3," (With hydrologic data)
(New Haven Water Co. Proposal)
Sept., 1959

"New Haven Water Co.,
Lake Saltonstall Proposed Spillway."
Clarence Blair Assc., Inc.
Dec., 1959

"New Haven Water Co.,
Lake Saltonstall Spillway, As Built."
Clarence Blair Assc., Inc.
Dec., 1960

<u>DATE</u>	<u>TO</u>	<u>FROM</u>	<u>SUBJECT</u>	<u>PAGE</u>
June 15, 1973	Files	Water Resources Com- mission Supervision of Dams	Inventory data	B-4
Aug. 12, 1974	Files	New Haven Water Co.	Statistics on Dams	B-5
June 19, 1959	Newman E. Argraves State Highway Comm- missioner State Highway Depart- ment	Joseph A. Novaro Chief Engineer New Haven Water Co.	Notification of damage to blowoff pipe	B-8
June 19, 1959	F. J. Callahan General Manager New Haven Water Co.	Joseph A. Novaro	Instructions concerning damaged blowoff pipe	B-9
June 26, 1959	Joseph A. Novaro	W. T. Schuler, Chief, Construction and Main- tenance, Conn. State Highway Dept.	Acknowledgement of damage to blowoff pipe	B-10
Aug. 26 1959	Robert A. Norton, Hydraulics Engineer Conn. Highway Dept.	T.H. Sellew, Asst. Chief of Design	Summary of proposed repairs and modifications to spillway	B-11
Aug. 27, 1959	William S. Wise, Director, Water Resources Comm.	Robert A. Norton	Request for issuance of permit to perform modifications	B-12
Aug. 28, 1959	John J. Mozzochi, Consulting Engineer	Merwin E. Hupfer	Request to review design data	B-13
Aug. 31 1959	Water Resources Commission	Robert A. Norton	Application for construc- tion permit	B-14

Sept. 11, 1959	William S. Wise	John J. Mozzochi	Review of design data; recommendation for issuance of construction permit	B-15
Dec. 11, 1959	Emitt A. Dell, Water Resources Commission	Roger C. Brown, Clarence Blair Assc., Inc.	Spillway modification data	B-16
Dec. 22, 1959	Water Resources Commission	Joseph A. Novaro	Application for construc- tion permit for spillway modification	B-17
Jan. 11, 1960	William S. Wise	John J. Mozzochi	Review of spillway hydrau- lic data; recommendation for issuance of construction permit	B-18
Dec. 5, 1960	William S. Wise	John J. Mozzochi	Recommendation for issuance of final approval	B-20
Jan. 4, 1961	New Haven Water Co.	William S. Wise	Certificate of approval	B-21

WATER RESOURCES COMMISSION
SUPERVISION OF DAMS
INVENTORY DATA

LONG 72-51.7

LAT 41-16.9

Inventory

by

on

JT
6/15/73

Name of Dam or Pond

Lake Saltonstall Dam

Code No.

EH2

Nearest Street Location

Rt 1

Town

East Haven

U.S.G.S. Quad.

Branford

Name of Stream

East Haven River

Owner

New Haven Water Co.

Address

100 Crown St.

New Haven

OK
7/63

DA 3925M

Pond Used For

Water supply storage

Dimensions of Pond:

Width 1000 ±

Length

5 miles

Area

368 acres

Total Length of Dam

120'

Length of Spillway

10'

Location of Spillway

Height of Pond Above Stream Bed

10'

Height of Embankment Above Spillway

4'

Type of Spillway Construction

CONCRETE

Type of Dike Construction

MASONRY

Downstream Conditions

Summary of File Data

Remarks

Would Failure Cause Damage?

Class

B-4

NEW HAVEN WATER COMPANY

STATISTICS ON DAMS*

NAME Saltonstall
SUPPLY SYSTEM Saltonstall
LOCATION East Haven - Branford
DATES: ORIGINAL CONSTRUCTION _____
ADDITIONS, ALTERATIONS 1949; 1960

	MEAN HIGH WATER ELEVATION	LENGTH
CREST**	24.3	92 \pm Ft.
TOP OF CORE WALL		
SPILLWAY	19.3	10 Ft.
B. O. AXIS	6.52	
BED OF RIVER	4 \pm	
DEEPEST FOUNDATION		

FREEBOARD: CREST TO SPILLWAY 5 Ft.

CREST TO TOP OF CORE WALL _____
HEIGHT: CREST TO BED OF BROOK 20 \pm Ft.

CREST TO DEEPEST FOUNDATION _____

TYPE Earth with Stone Facing

TOP WIDTH--MAX. BOTTOM WIDTH (Ft.) _____

UPSTREAM SLOPE H/V Vertical

DOWNSTREAM SLOPE H/V _____

TRIBUTARY WATERSHED (Square Miles) 13.8

RESERVOIR AREA (Acres) 388.4

RESERVOIR TOTAL STORAGE (MG) _____

RESERVOIR USABLE STORAGE (MG) 1500

*See individual sheets for more details

**Crest Length includes spillway

Date 8/12/74

DATE Aug. 1974

OF DAM SALTONSTALL

th embankment with stone masonry facing on upstream of dam. Downstream embankment now incorporated in the highway embankment of U.S. Highway No. 1. Concrete way discharging into a 36" x 58" corrugated arch pipe under surface of highway which connects to a large concrete drainage structure in southern portion of highway embankment.

ION

See Map 90133

the north side of U.S. Highway No. 1 (Boston Post Road) the East Haven - Branford Town Line

See U.S.G.S. BRANFORD QUADRANGLE MAP

Y SYSTEM SALTONSTALL

OF CONSTRUCTION

INAL 1882 - earth dam with rubble stone corewell & 24" B.O. pipe. ER 1949 - blowoff gate valve at face of dam no longer operable. was replaced with a new valve located in a concrete chamber 100 feet upstream from face of dam with access by a bridge. See map file 40060 for plans.

0 - New concrete spillway constructed and masonry facing of m raised with concrete to elevation 24.3 M.H.W. New 36" x 58" corrugated metal pipe installed under highway replacing two small pipes that formerly carried the spillway flow. See map files 90133 & 90132

ER

7. CONTRACTOR

2 Phineas E. Ball

Worcester, Mass. (N.H. Water Co.)

Clarence Blair Assoc. Inc.

New Haven Water Co.

Clarence Blair Assoc. Inc.

New Haven Water Co.

	ELEVATION	LENGTH (Feet)	MISC.
T	24.3 M.H.W.	± 92	
NAY	19.3 "	10	
OF B.O.	6.52 at B.O. valve chamber		24" B.O.
= RIVER	± 4 M.H.W.		
ST FNDN.			

NEW HAVEN WATER COMPANY
SALTONSTALL DAM.

Pg. 2

DATE

EIGHT FROM BED OF BROOK ± 20 Feet
EIGHT FROM DEEPEST FOUNDATION Feet
TOP WIDTH Part of highway width Feet
MAXIMUM WIDTH AT BOTTOM Feet
UPSTREAM SLOPE Vertical Stone Masonry Face
DOWNSTREAM SLOPE

REE BOARD - SPILLWAY TO CREST 5 Feet
- SPILLWAY TO TOP OF COREWALL Feet

MISC. DATA

Pumping Station established in 1882

Note: See specifications in this file for an earth dam with rubble stone wall within the earth embankments at outlet of Lake Saltonstall.

WATERSHED TRIBUTARY TO:

UPSTREAM DAMS Farm River Div. Dam via Saltonstall Tunnel 11.1 Sq. Mi.
THIS DAM 2.7 Sq. Mi.
TOTAL WATERSHED TRIBUTARY TO THIS DAM 13.8 Sq. Mi.

RESERVOIR AREA AT FLOW LINE 388.4 Acres
RESERVOIR CAPACITY AT FLOW LINE Mil. Gal.
RESERVOIR USABLE CAPACITY (~~To lowest outlet~~) Top 15 ft. 1500 Mil. Gal.

UPSTREAM DAMS

None

DOWNSTREAM DAMS

None

STATE OF CONNECTICUT

STATE HIGHWAY DEPARTMENT

24 VERNON HILL ROAD WETHERSFIELD

P. O. BOX 2188 HARTFORD 11, CONN.

JUNE 20, 1959

June 19, 1959

In reply please
refer to Unit #

Mr. Newman E. Argraves,
State Highway Commissioner,
State Highway Department,
P. O. Box 2188,
Hartford, Conn.

Dear Sir:

We are writing about a most urgent matter which requires
prompt action.

The spillway overflow from our Lake Saltonstall dam adjacent
to Route No. 1 at the East Haven-Branford Town Line is carried under
the State Highway embankment by drainage pipes installed at the time
the highway was built. In May we discovered that these pipes had been
crushed from above and completely blocked by embankment fill settling
into the space formerly occupied by these pipes. The settlement created
a 4-foot deep hole under the highway pavement. We made an inspection
with highway engineers on May 15th.

With the spillway discharge completely blocked a most dangerous
situation has been created. We are attempting to control storm runoff
by operating the 24" blowoff pipe under the dam. However, this is
totally inadequate for large storm runoff. If a very large storm should
occur the dam and adjacent highway embankment can be topped. Failure
of the highway embankment would release about a billion and a half
gallons of water downstream, with severe property loss and possible loss
of life.

We have had further discussions and meetings with your local
office and officials at your Wethersfield Office and they are familiar
with the situation.

In view of the dangerous situation that exists, it is imperative
that every effort be made to expedite the engineering and reconstruction
of these drainage facilities.

Yours very truly,

By NEW HAVEN WATER COMPANY

Chief - Construction and Maintenance

Joseph A. Novaro
Chief Engineer

Certified Mail
Copy to Mr. Bowerman

June 19, 1959

Mr. F. J. Callahan,
General Manager.

Dear Sir:

In view of the dangerous situation which exists at Lake Saltonstall I would suggest that in addition to operating the blow-off pipe, the Saltonstall Tunnel be shut down to eliminate that large watershed from Lake Saltonstall and that it be operated only in the event Saltonstall needs major replenishing.

It might be well also to supply Mr. Stokes with a quantity of sand bags in the event a heavy storm arrives, so that Harry could sandbag the top of the dam to prevent overflow. I believe also that Harry should be fully advised of this dangerous situation and given complete instructions as to procedure to take and who to notify.

Yours very truly,
NEW HAVEN WATER COMPANY

Joseph A. Novaro
Chief Engineer



STATE OF CONNECTICUT

STATE HIGHWAY DEPARTMENT

24 WOLCOTT HILL ROAD WETHERSFIELD

P.O. BOX 2188 . . HARTFORD 15, . . . CONNECTICUT

June 26, 1959

In reply please
refer to Unit #501

New Haven Water Company
100 Crown Street
New Haven 6, Connecticut.

Attention: Joseph A. Novaro, Chief Engineer

Gentlemen:

This will acknowledge your letter of June 19, 1959 and our subsequent meeting of June 24, 1959 concerning the condition of the blow-off outlet from your Lake Saltenstall dam adjacent to Route #1, and also the drainage pipe carrying the overflow from the spillway.

Considering the urgency of the situation relative to the replacement of the blow-off pipe, the Department will upon conclusion of a satisfactory agreement with the New Haven Water Company, incorporate the installation of the blow-off pipe in the proposed contract for the replacement of the culvert pipes. We will also do everything possible to expedite the engineering necessary.

It is my understanding that your engineering consultant will present your construction requirements, as they effect the installation of your blow-off pipe, to our District Engineer in order that these requirements may be incorporated in the plans.

Very truly yours,

Newman E. Argraves
State Highway Commissioner

By


W. T. Schuler

Chief - Construction and Maintenance

c
o
p
y

Project No. 43-63
Drainage on Route U.S. 1 at Lake Saltonstall
East Haven & Branford

8-26-59

Mr. R. A. Norton

T. H. Sellow

Forwarded herewith are prints of the preliminary plans and hydraulic data for the above project. Please review the hydraulic characteristics of the proposed overflow and make the necessary applications for a permit for the modification of the existing dam and for approval of waterway to the Water Resources Commission.

The modifications to the existing dam consist of the removal of a 12 foot section, 5 feet deep, of the existing wet masonry dam, the rebuilding of any adjacent sections which may be loosened or weakened in the process, and the installation of a cast-in-place reinforced concrete spillway which will have a 10 foot by 3 foot opening with a bar screen. According to the SOILS investigation, there was no masonry encountered in a test hole bored 6 feet from the face of the dam, so it is considered to be a masonry faced earth dam. Accordingly, we are proposing no excavation closer than a 1:1 slope line from the water surface except where protected by sheet piling which will be left in place.

The 10 ft. by 3 ft. opening with bar screen was proposed by the New Haven Water Company. With the worst conditions, assuming no water drawn from the reservoir by that company, a rise of approximately 2.3 feet in the water surface can be expected.

This will not, apparently, cause flooding of any property other than that of the water company and will leave a free board of approximately 2 feet at the dam.

Please secure approval and permits as soon as possible. This project is scheduled for advertising as soon as completed.

/s/ T.H. Sellow - J.M.

Assistant Chief - Design

AJT:ama

Attach.

CC - Mr. D. S. Johnson

Mr. T. H. Sellow

Mr. H. T. Davidson

Central Files

8-27-59

Mr. William S. Wise

Water Resources Commission

Robert A. Norton

Highway


Proposed Culvert - Route U.S. 1 at Outlet of Lake Saltonstall
Towns of East Haven and Branford - Project 43-63

Forwarded herewith are preliminary design and hydraulic data for the replacement of the culvert under Route U.S. 1 at the outlet of Lake Saltonstall in East Haven and Branford. Also included is a memorandum of explanation from Mr. T. H. Sellw dated 8-26-59. One set of the preliminary plans, hydraulic data and memorandum was delivered to Mr. C. J. Pelletier on 8-26-59.

The proposed work includes the replacement of the culvert and also a modification of the spillway of the dam to improve the inlet conditions to the culvert. Since this dam is located within the Highway right-of-way, permit for the modification of the dam is being requested by the Highway Department.

It is requested that you review the proposed structure for conformance with waterway requirements which you may establish for this stream. It is also requested that you issue a permit for the modification of the dam contingent upon the approval of the Highway Department's plan by the New Haven Water Company.

The existing culvert has partially collapsed and it is urgent that the replacement be made as soon as possible since the embankment around the culvert may settle, causing the road to become impassable.


Robert A. Norton
Hydraulics Engineer

Attach.
HAN:hl

August 28, 1959

Mr. John J. Moszochi, Consultant Engineer
265 Helron Avenue
Glastonbury, Connecticut

Code No. L38.1, EH3.1

Dear Mr. Moszochi:

We are enclosing preliminary plans, hydraulic data and correspondence relative to the proposed alterations to Lake Saltonstall Dam in the Towns of East Haven and Branford. This dam, owned by the New Haven Water Company, is located on State Highway Department property.

Under your contract as a consultant to this Commission, will you kindly perform the work indicated at your earliest possible convenience as this project appears to be most urgent.

Very truly yours,

Marvin E. Hupfer
Senior Sanitary Engineer

MEH:gd

Encls.

STATE OF CONNECTICUT
WATER RESOURCES COMMISSION
Room 317, State Office Building
Hartford, Connecticut

RECEIVED

SEP 1 1959

State Water Resources Commission

APPLICATION FOR CONSTRUCTION PERMIT FOR DAM

New Haven Water Co.

Date Aug. 31, 1959

Address 100 Crown St.

New Haven, Conn.

Tel. No. Main 4-9803

Location of Structure:

at Branford & East Haven

Shown on USGS Quadrangle Branford, Conn.

Location of Stream Outlet, Lake Saltonstall

at 3.75 inches south of Lat. $41^{\circ}-15'$
northand 1.45 inches east of Long. $72^{\circ}-52'-30''$
westDirections for reaching site from nearest village or route intersection:
(see sketch on reverse side)

Route U.S. 1 on Branford-East Haven Town Line

This is an application for: ~~(New Construction)~~ (Alteration) ~~(Repair)~~ ~~(Removal)~~
(check one or more of above)

The pond is to be used for: Water Supply

Dimensions of Pond: width 1,200 ft. length 16,000 ft. area 430 acres

Minimum depth of water immediately above dam: 8 ft.

Length of dam: 80 ft.

Location of spillway: See attached plan

Location of abutments above spillway: "

Type of spillway construction: "

Type of dike construction: "

Foundation section will be set on: (Bedrock) (Gravel) (Clay) (Till)

(check one of above)

Remarks: Dam owned by New Haven Water Co. Located on State of Connecticut Right-of-Way

U.S. 1. See memo dated 8-27-59

Signed:

Name of Engineer, if any

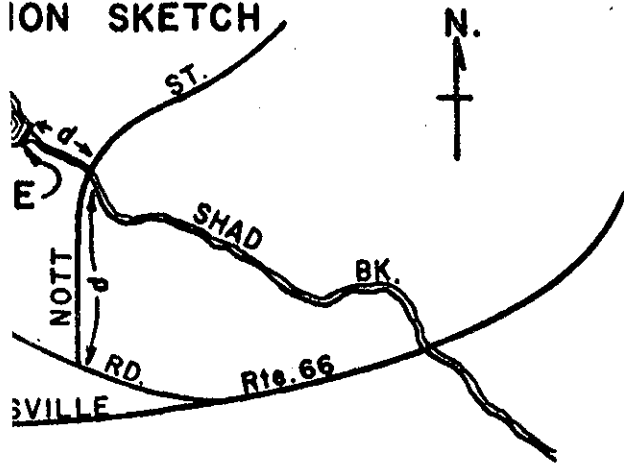
Show details of
construction on reverse side.

(owner)
Robert A. Norton
Hydraulics Engineer
Connecticut State Highway Department

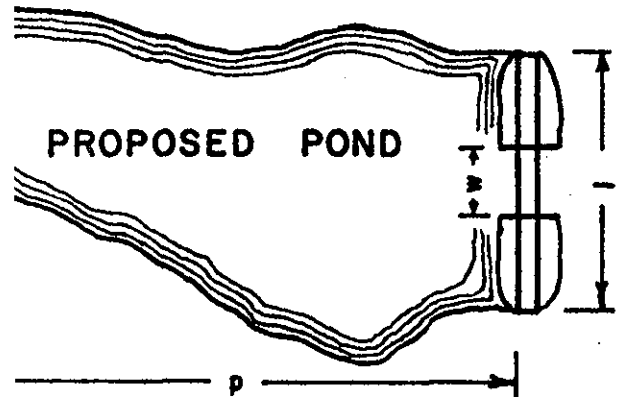
B-14

SAMPLE DATA

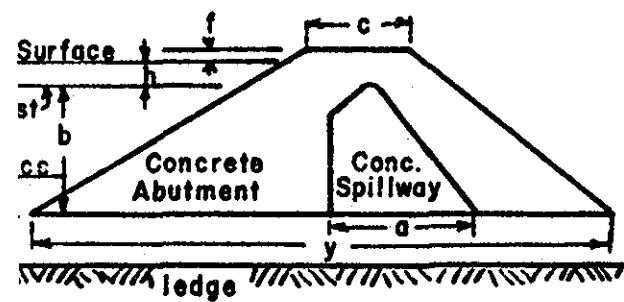
ION SKETCH



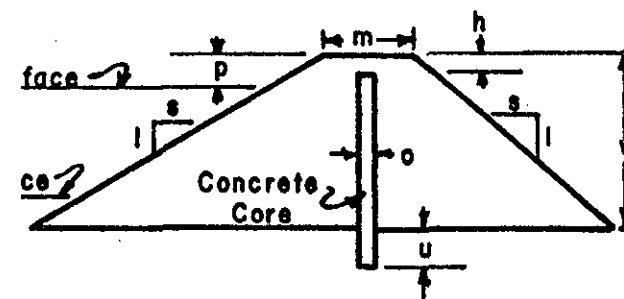
PLAN



WAY SECTION



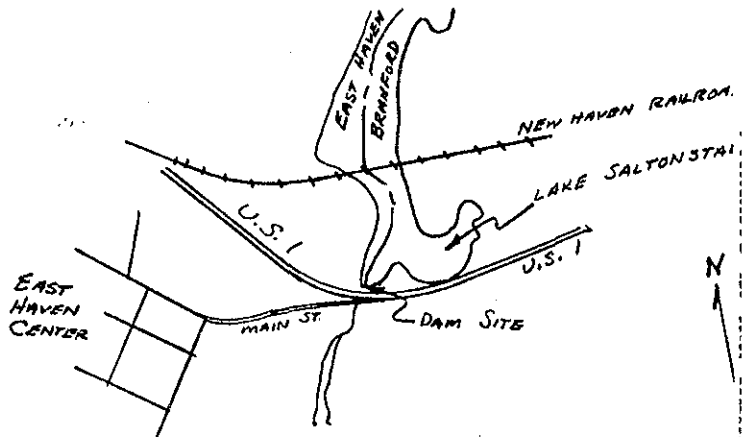
SECTION



APPLICANT'S DATA

Show only features of sample which are applicable and dimensions which reflect your intention

LOCATION SKETCH

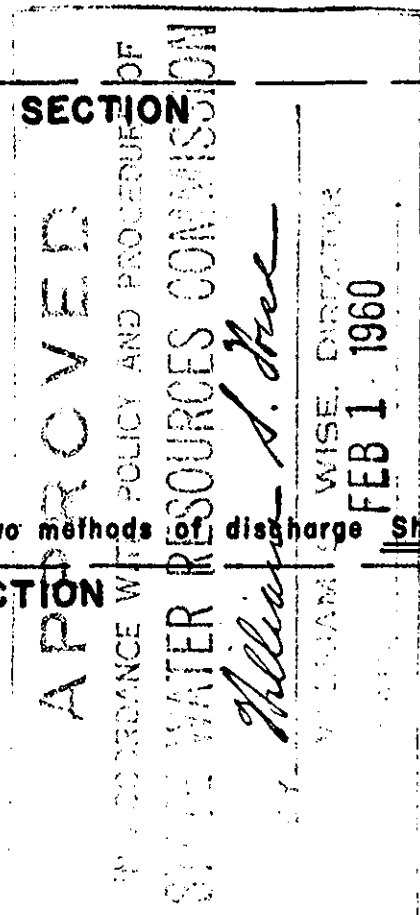


SITE PLAN

SPILLWAY SECTION

NOTE... If there are two methods of discharge Show Bo

DIKE SECTION



RECEIVED
SEP 14 1959
State Water Resources Commission

JOHN J. MOZZOCHI AND ASSOCIATES
CONSULTING ENGINEERS

JOHN J. MOZZOCHI
ASSOCIATES
JOHN J. WHITE
JOHN LUCHS, JR.

September 11, 1959

217 HERRON AVENUE
GLASTONBURY, CONN.
PHONE MEFORD 3-9401

Sam S. Wise - Director
State Water Resources Commission
Office Building
Meadford 15, Connecticut

CODE NO. L 38.1, EH 3.1

Re: Our File 57-73-23
Towns of East Haven and Branford
Alterations to Lake Saltonstall Dam

Mr. Wise:

In accordance with your authorization dated August 28, 1958, I have reviewed the design and hydrology data on the above referenced project and find them to be substantially correct.

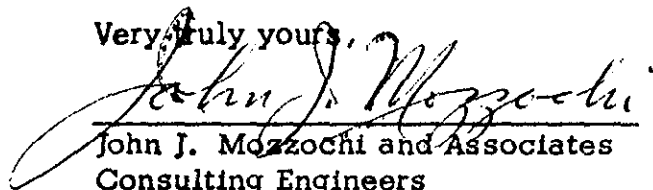
Two methods of approach in determining the correctness of the spillway design were used:

- (1) A design storm of 15" with 13.5" runoff having a duration of 6 hrs was routed to the pond area of the watershed. Computations show that at the peak of this storm the depth of water going over the spillway would be approximately 1 ft.
- (2) Mean annual run off, for the drainage area, using Bigwoods formula was computed. Using a factor of 5 times the mean annual flood and with storms having durations of 1 hr; 4 hr; 8 hr; and 12 hr, depths of water going over the spillway were computed. These showed depths of 0.3 ft; 1.0 ft; 2.1 ft and 2.8 ft. The 12 hr storm would reduce the freeboard to 1.5 ft. However, a storm of this magnitude is well beyond the range of a 300 year storm.

Based on our computations, we recommend that a construction permit be issued for this project.

We are retaining the hydrology computations in our files.

Very truly yours,


John J. Mozzochi and Associates
Consulting Engineers

thk

B-16

CLARENCE BLAIR ASSOCIATES, INC.*Civil Engineers*

P.O. BOX 236 SPRUCE 7-7379

93 WHITNEY AVENUE — NEW HAVEN, CONN.

State Water Resources CommissionL. BROWN
J. BEACH
J. AGAINIS. E. AUGUR, JR.
BILIDES
BREST
L. DISBROW
W. PIPERAS, JR.WATER SUPPLY
SEWAGE DISPOSAL
WASTE DISPOSAL
SURVEYS
LAND DEVELOPMENT

December 11, 1959

State of Connecticut
Water Resources Commission
State Office Building
Hartford 15, Connecticut

Attention: Mr. Emitt A. Dell

Gentlemen:

Enclosed is a plan showing proposed changes in the spillway of the dam at the New Haven Water Company's Lake Saltonstall in the Towns of Branford and East Haven. The Water Company intends to make these changes in conjunction with the Connecticut State Highway Department's Drainage Improvement Project No. 43-63.

The Highway Department made application to your office for a construction permit for this project on September 18, 1959 and received a permit dated August 31, 1959.

Under the present plans, the Highway Department's project would terminate just south of the dam and the Water Company would be responsible for the construction pertaining to the dam itself as shown on the enclosed plan.

The New Haven Water Company is therefore making application for a construction permit for these changes.

In addition to the change in spillway shown on the plan, the Water Company intends to add approximately one foot of concrete wall to the top of the existing masonry dam westerly of the spillway opening, bringing the top of the dam up to Elevation 26.09.

We will be glad to answer any questions or fill out forms if they are required.

Very truly yours,

CLARENCE BLAIR ASSOCIATES, INC.

Roger C Brown

Roger C. Brown

B-17

RCB:mmg
Encl.

STATE OF CONNECTICUT
WATER RESOURCES COMMISSION
Room 317, State Office Building
Hartford, Connecticut

RECEIVED

DEC 24 1959

State Water Resources Commis

APPLICATION FOR CONSTRUCTION PERMIT FOR DAMOwner New Haven Water CompanyDate December 22, 1959P. O. Address 100 Crown StreetNew Haven, ConnecticutTel. No. MA. 4-9803

Location of Structure:

Branford

Town East Haven and BranfordShown on USGS Quadrangle 1:31680Name of Stream East Haven Riverat 2.0 inches south of Lat. 41-17-30and 1.5 inches east of Long. 72-52-30

Directions for reaching site from nearest village or route intersection:
(see sketch on reverse side)

0.67 miles east of East Haven center on Route U.S. 1

X

This is an application for: (New Construction) (Alteration) (Repair) (Removal)
(check one or more of above)

This pond is to be used for: Water supply storageDimensions of Pond: width 1000' ± length 5 miles area 388 AcresMaximum depth of water immediately above dam: 10 feetTotal length of dam: 120 feetLength of spillway: 10 feetHeight of abutments above spillway: 4 feetType of spillway construction: See PlanType of dike construction: See Plan

Spillway section will be set on: (Bedrock) (Gravel) (Clay) (Till)
(check one of above)

Remarks: This is an alteration and enlargement of existing spillway. Thelower part of the dam will not be disturbed.

Signed: New Haven Water Co.
Joseph A. Novak, Chief Engineer.
(owner)

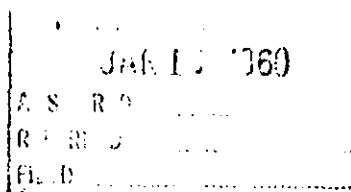
Name of Engineer, if any Clarence Blair Associates, Inc.

Note: Show details of
construction on reverse side.

Roger C. Brown

B-18

N. J. MOZZOCHI AND ASSOCIATES
CONSULTING ENGINEERS



217 HEBRON AVENUE
GLASTONBURY, CONN.
PHONE MEDFORD 3-9401

MOZZOCHI
OCIATES
J. WHITE
LUCHS, JR.

January 11, 1960

William S. Wise-Director
Water Resources Commission
State Office Building
Hartford 15, Connecticut

STATE WATER RESOURCES COMMISSION RECEIVED JAN 12 1960 ANSWERED REFERRED <i>Agenda</i> FILED	Code No. L-38.1 EH 3.1 Our File 57-73-23 Alterations Lake Saltonstall Dam Towns of East Haven & Branford
---	---

Mr. Wise:

In accordance with instructions in letter of January 4, 1960 from Merwin Hupfer, I have reviewed the application from the New Haven Water Company for referenced work.

This project is a joint proposal between the State Highway Department and New Haven Water Company with the Highway Department installing 36 inch C.C.M. pipe outfall and the Water Company building the 10' x 3' spillway. Additional off capacity is provided by a 24" gate valve which discharges independently of the A.C.C.M. pipe and is controlled by daily supervision by Water Company personnel.

With hydraulic data available, we foresee a possibility, under conditions 12.3" runoff and no discharge through the system, of a rise in the lake level of about 3 feet. This will reduce the available freeboard to about one (1) foot.

I met Mr. Joseph Navarro, Engineer for the Water Company, and Mr. Roger Brown of Clarence Blair Associates, consultants for the Water Company at the site. They agreed to raise the proposed top of the masonry dam by an additional foot from elev. 26.09 to elev. 27.10 and thereby insure that a minimum freeboard of 2 feet will be available under the most adverse conditions.

I recommend that a construction permit be issued for the work with the addition that the top of the masonry dam be raised to a minimum elevation of 27.10.

Very truly yours,

John J. Mozzochi
John J. Mozzochi and Associates
Consulting Engineers

AHK

Carl. of [unclear]

JOHN J. MOZZOCHI AND ASSOCIATES
CIVIL ENGINEERS

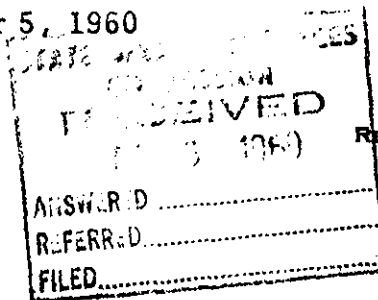
GLASTONBURY, CONN.
217 HEBRON AVENUE
PHONE MEDFORD 3-9401

JOHN J. MOZZOCHI

ASSOCIATES

OWEN J. WHITE
JOHN LUCHS, JR.
ECTOR L. GIOVANNINI

December 5, 1960



PROVIDENCE 3, R. I.
200 DYER STREET
PHONE GASPEL 1-0420

REPLY TO: Glastonbury

Mr. William S. Wise - Director
Water Resources Commission
State Office Building
Hartford 15, Connecticut

Re: Code No. L-38.1 EH 3.1
Our File 57-73-23
Alterations Lake Saltonstall Dam
Towns of East Haven & Branford

Dear Mr. Wise:


A final inspection was made of the referenced project today and found to be satisfactory in every detail.

Several changes from the original plans were made during construction and, by copy of this letter, I am requesting Mr. Roger Brown of Clarence Blair Associates, Engineers for the New Haven Water Company, to submit "As Built" plans for file purposes.

Since one of the changes was an increase in the size of the pipe culverts, it will be of interest to Mr. Charles Pelletier insofar as channel lines are concerned.

I recommend that a Final Permit be issued to the New Haven Water Company for this project.

Very truly yours,


John J. Mozzochi and Associates
Civil Engineers

JJM:hk

cc: Mr. Roger Brown
Clarence Blair Associates, Inc.

STATE OF CONNECTICUT
WATER RESOURCES COMMISSION
Room 317, State Office Building
Hartford, Connecticut

CERTIFICATE OF APPROVAL

Date January 4, 1961

To: New Haven Water Company
100 Crown Street
New Haven, Connecticut

NAME OF STRUCTURE: Lake Saltonstall Dam

This is to certify that the following construction work:

Alterations to the subject dam; in accordance with "As Built" plan
consisting of one sheet marked K-521B, dated December 1960 and pre-
pared by Clarence Blair Associates, Inc; which is owned by the New
Haven Water Company and is located on State Highway Department
right-of-way

on your property _____
in the Town (s) of Branford and East Haven
for which construction permit was issued February 1, 1960, has been
completed to the satisfaction of this Commission and that such structure
is approved as of date of this Certificate.

WATER RESOURCES COMMISSION

BY: William S. Wise
William S. Wise, Director

Note: The owner is required by law to record this Certificate in the
land records of the town or towns in which the dam, dike or similar
structure is located.

cc: State Highway Department

B-21

APPENDIX C

DETAIL PHOTOGRAPHS

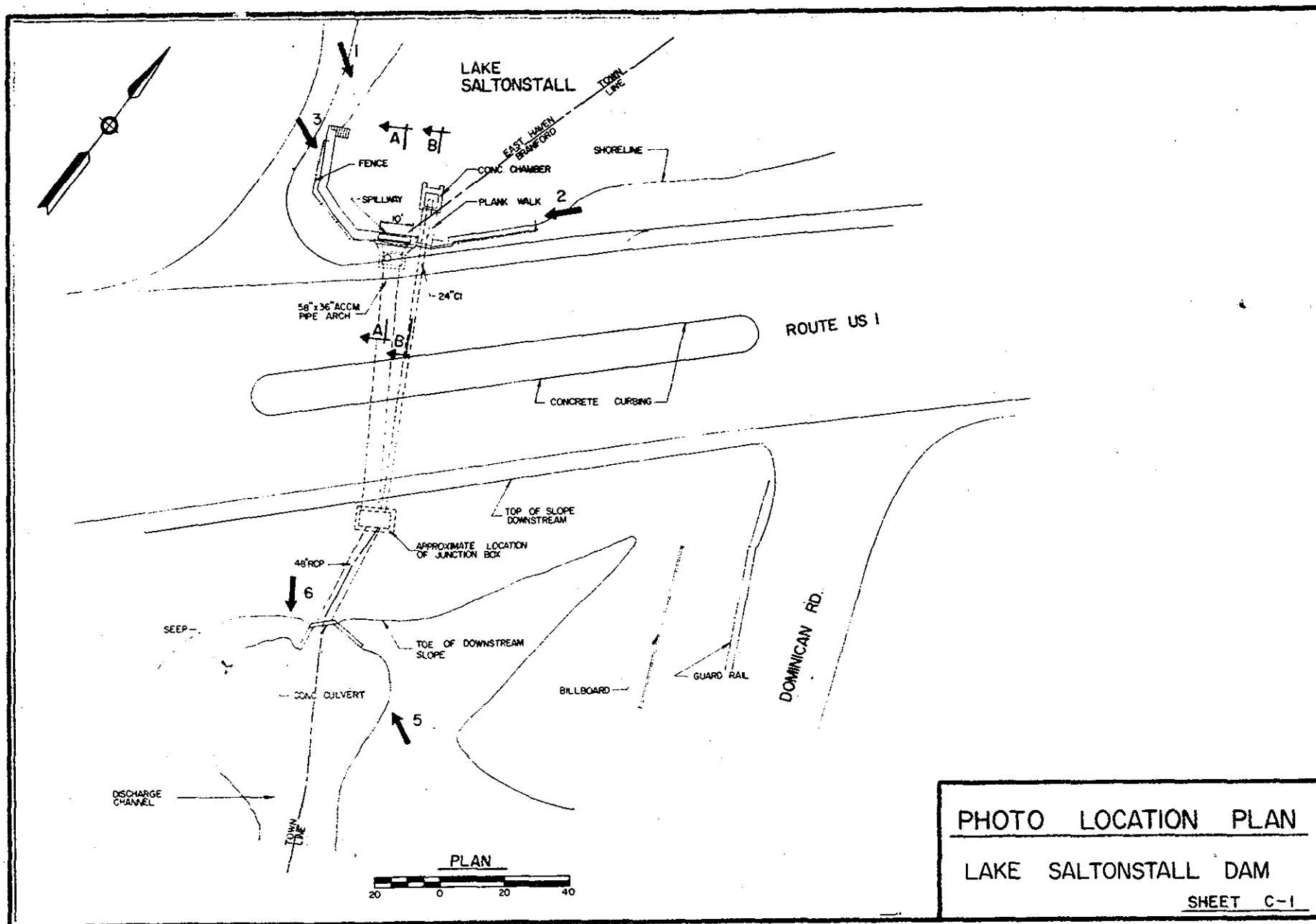




PHOTO 1 - General view of upstream face of dam.



PHOTO 2 - Upstream stone masonry wall. Note spalling of concrete immediately to left of low level outlet gate access bridge.

ARMY ENGINEER DIV. NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

CAHN ENGINEERS INC.
WALLINGFORD, CONN.
ENGINEER

NATIONAL PROGRAM OF
INSPECTION OF
NON-FED. DAMS

Lake Saltonstall Dam

Tr. Farm River

East Haven-Branford, CT

CE# 27 660 KA

DATE May '79 PAGE C-1



PHOTO 3 - Close up of bar screen across spillway inlet.



PHOTO 4 - Arch conduit through railroad embankment upstream of dam. Embankment acts as a constriction regulating flow to dam.

RMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS. CAHN ENGINEERS INC. WALLINGFORD, CONN. ENGINEER	NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS	Lake Saltonstall Dam
		Tr. Farm River
		East Haven-Branford, CT
		CE# 27 660 KA
		DATE May '79 PAGE C-2



PHOTO 5 - Downstream slope and low level outlet conduit. Note sloughing and erosion of slope, and deterioration of outlet wingwalls.



PHOTO 6 - View of downstream slope and channel from top of slope. Note erosion of slope.

ENGINEER DIV. NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

CAHN ENGINEERS INC.
WALLINGFORD, CONN.
ENGINEER

NATIONAL PROGRAM OF
INSPECTION OF
NON-FED. DAMS

Lake Saltonstall Dam

Tr. Farm River

East Haven-Branford, CT

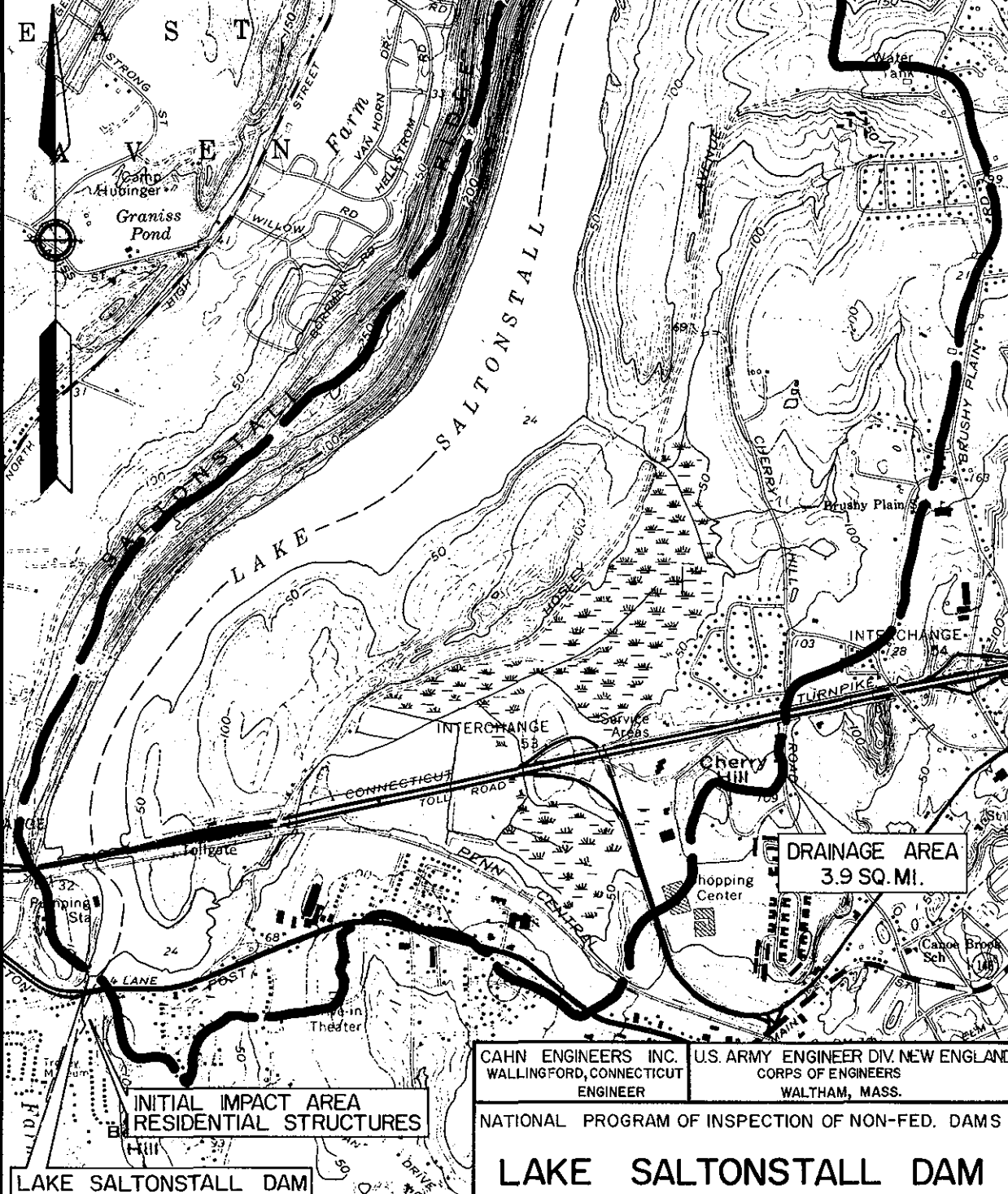
CE# 27 660 KA

DATE May '79 PAGE C-3

APPENDIX D
HYDRAULICS/HYDROLOGIC COMPUTATIONS

USGS QUADRANGLE
BRANFORD 1972

SALTONSTALL
TUNNEL



INITIAL IMPACT AREA
RESIDENTIAL STRUCTURES

LAKE SALTONSTALL DAM

DRAINAGE AREA
3.9 SQ. MI.

CAHN ENGINEERS INC.
WALLINGFORD, CONNECTICUT
ENGINEER

U.S. ARMY ENGINEER DIV. NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

LAKE SALTONSTALL DAM

TR- FARM RIVER

EAST HAVEN, BRANFORD, CONNECTICUT

DWN. BY M.N.	CKD. BY CRG	APP. BY PMH	SCALE: 1" = 2000	DATE: JUNE 1979	SHEET D-1
-----------------	----------------	----------------	------------------	-----------------	-----------

INSPECTION OF NON-FEDERAL DAMS IN NEW ENGLAND

Sheet D-1 of 15

1 By Hep Checked By CR

Date 6/11/79

ok Ref. Other Refs. CE#27-660-KA

Revisions

HYDROLOGIC/HYDRAULIC INSPECTION

LAKE SALTONSTALL DAM, EAST HAVEN/BRANFORD, CT.

J) PERFORMANCE AT TEST FLOOD CONDITIONS:

1) MAXIMUM PROBABLE FLOOD:

a) WATERSHED CLASSIFIED AS "ROLLING"

b) WATERSHED AREA

THE LAKE SALTONSTALL WATERSHED INCLUDES A TUNNEL DIVERSION FROM THE FARM RIVER DRAINAGE AREA. THIS DIVERSION, HOWEVER, IS CONTROLLED BY GATES AT THE TUNNEL INLET* AND THEREFORE, IT CAN BE CLOSED TO LAKE SALTONSTALL AS A PART OF THE OPERATIONAL PROCEDURES OF AN EMERGENCY WARNING SYSTEM. THEREFORE, FLOW FROM THIS CONTROLLED DIVERSION WILL NOT BE CONSIDERED IN THIS ANALYSIS.

LAKE SALTONSTALL IS CROSSED BY A R.R. OVER AN EMBANKMENT WITH A STONE MASONRY CULVERT**. THIS CROSSING DIVIDES THE LAKE'S WATERSHED, AND CONTROLS THE FLOW FROM THE UPPER INTO THE LOWER PORTION OF THE LAKE. INTERSTATE RTE. I-95 (CONN. TPKE.) ALSO CROSSES LAKE SALTONSTALL OVER A BRIDGE WHICH IS NOT CONSIDERED TO HAVE ANY EFFECT UPON THE FLOW AT THE LAKE.

* INFORMATION BY THE NEW HAVEN WATER CO. TO C.E. (G. STEPHENS) ON 6/5/79

** STONE ARCH CULVERT (±) 41' LONG; 10' WIDE X 10' HIGH TO CROWN (5' RAD. ARCH) W/ INLET AND OUTLET WINGWALLS PARALLEL TO FLOW. INV. EL. (±) 17.3' MSL; RR BED (±) EL. 36' MSL W.S. EL. (±) 22.4' MSL ON 6/5/79 (i.e., 5' DEEP TO CULV. INV.). BOTTOM @ OUTL. PILES ± 3' TO A ROCK SILL (±) 2' HIGH, LOCATED ± 6.5' BEYOND THE CULV. PILE. SILL SPANS 14' BET. WINGWALLS; BOTTOM @ PILES ± 14' MSL

NON-FEDERAL DAMS INSPECTION

Sheet 2 of 15
 Date 6/11/79
 Revisions _____

By HLL Checked By CRG
 ok Ref. _____ Other Refs. CE #27-660-KA

LAKE SALTONSTALL DAM

1.6-Contd) MAXIMUM PROBABLE FLOOD - WATERSHED AREA

i) TOTAL * D.A. ≈ 3.92 sq mi (1/2 FARM RIVER DIV. OF 11.1 sq mi (NHWCO))

ii) D.A. 1/2 FROM R.R. EMBANKMENT/CULVERT: D.A. ≈ 2.85 sq mi (CE)

iii) D.A. 1/2 FROM R.R. EMBANKMENT/CULVERT: D.A. ≈ 1.07 sq mi (CE)

* NOTE: DATA FROM CONN. D.E.P. WATER AND RELATED RESOURCES, INVENTORY SHEET DATED 6/15/73: D.A. = 3.92 sq mi, C.E. CHECK: D.A. = 3.92 sq mi, NEW HAVEN WATER CO., "STATISTICS ON DAMS", DATED AUG. 1974, GIVES D.A. = 2.7 (2) sq mi

c) FROM NED-ACE "PRELIMINARY GUIDANCE FOR ESTIMATING MAX. PROBABLE DISCHARGES" - GUIDE CURVE FOR PMF - PEAK FLOW RATES.

i) (PMF)₁ ≈ 1900 cfs/sq mi FOR TOTAL D.A.

ii) (PMF)₂ ≈ 2000 cfs/sq mi FOR THE AREA 1/2 FROM THE R.R. CROSSING

iii) (PMF)₃ ≈ 2300 cfs/sq mi FOR THE AREA 1/2 FROM THE R.R. CROSSING.

d) PEAK INFLOW

THE R.R. CROSSING (EMBANKMENT w/ CULVERT) WILL SIGNIFICANTLY CONTROL THE PEAK INFLOW TO SALTONSTALL DAM. HOWEVER, BECAUSE THIS IS A MAN MADE STRUCTURE, CROSSING THE BODY OF WATER, WHOSE STRUCTURAL CONDITION TO WITHSTAND A DIFFERENTIAL HEAD IS UNKNOWN AND WHICH COULD BE AT ANY TIME REMOVED, THE LAKE SALTONSTALL DAM PERFORMANCE AT TEST FLOOD WOULD BE ANALYZED WITHOUT THE PEAK ATTENUATING EFFECT OF THE R.R. EMBANKMENT/CULVERT I.E., AS IF THE R.R. EMBANKMENT WERE REMOVED.

NON-FEDERAL DAMS INSPECTIONSheet D-3 of 15ed By WHLChecked By CPGDate 6/12/79

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LAKE SALTONSTALL DAM1.d - Cont'd) MAXIMUM PROBABLE FLOOD - PEAK INFLOW

THE PEAK INFLOWS CORRESPONDING TO THE ABOVE UNIT PMF'S ARE AS FOLLOWS:

i) $(PMF)_1 \approx 3.92 \times 1900 \approx 7450 \text{ CFS}$ (TOTAL WATERSHED)

ii) $(PMF)_2 \approx 2.85 \times 2000 \approx 5700 \text{ CFS}$ (1/5 FROM RR CROSSING)

iii) $(PMF)_3 \approx 1.07 \times 2300 \approx 2460 \text{ CFS}$ (1/5 FROM RR. CROSSING)

HOWEVER, AS A RESULT OF THE PREVIOUS CONSIDERATIONS, ONLY $(PMF)_1$ FOR THE ENTIRE WATERSHED WILL BE USED IN THE FOLLOWING ANALYSIS.

2) SPILLWAY DESIGN FLOOD (SDF)a) CLASSIFICATION OF DAM ACCORDING TO NED-ACE RECOMMENDED GUIDELINES.

i) SIZE: $\text{STORAGE (MAX)} \approx 6900 \text{ AC-FT}$ ($1000 < S < 50000$)
 $\text{HEIGHT} \approx 25'$ $H \approx 25'$

Storage: FROM NEW HAVEN WATER CO. INVENTORY (STATISTICS ON DAMS) DATED 8/12/74: RESERVOIR USABLE CAPACITY ("TOP 15 FT") $S = 1500 \text{ AC-FT} \approx 4600$
 ALSO, NHHWC DATA SHEET B-899 "AVAILABLE STORAGE IN LAKE SALTONSTALL" SHOWING APPROX. AVAILABLE STORAGE/ADEQ CURVES AND CAPACITY TABLE, $S = 1500$ FROM ELEV. 7.1' MSL (4.3' MHHW) - SEE NOTE NEXT PAGE TO FLOW LINE ELEV. 22.1' MSL (19.3' MHHW). NHHWC. RESERV. BOTTOM EL. (5) 6.8' MSL (4' MHHW), THUS,

NON-FEDERAL DAMS INSPECTION

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LAKE SUTTONSTALL DAM

2.2. (Cont'd) CLASSIFICATION OF DAM ACCORDING TO RED-AGE GUIDELINES.

STORAGE (Cont'd) ASSUME AN ADDITIONAL 100 ACFT ($\frac{4600}{15} \times 0.3 = 92$) TO THE BOTTOM OF THE DAM, OR, STORAGE TO FLOW LINE. $S_N = 4700$ AC-FT. AREA AT FLOW LINE (N.H.W.C.) $A_N = 388.4$ AC; C.E. LAKE AREA MEASURE AT USGS BRANFORD, CT. QUAD. SHEET, EL. 24' MSL: $A_N = 386$ AC; AT CONTOUR EL. 30' MSL $A_N = 471$ AC. \therefore ASSUME TOT. AREA AVE: $\bar{A}_{TOT} = 430$ AC. STORAGE TO TOP OF DAM (EL. 27.1' MSL ≈ 24.3 MHW): $S_{MAX} = 4700 + 430 \times 5 = 6900$ AC-FT

NOTE: AREA OF LAKE $\frac{1}{4}$ FROM RR. CROSSING $A_U = 358$ AC AND $\frac{3}{4}$: $A_U = 30$ AC
 \therefore ASSUME AVE AREAS WITHIN THE EXPECTED SURCHARGE OF $\bar{A}_U = 396$ AC
 AND $\bar{A}_D = 35$ AC; I.E. $\bar{A}_{TOT} = 430$ AC (AS ABOVE)

HEIGHT: FROM THE SAME DATA SOURCES AS ABOVE, HEIGHT FROM NATURAL STREAM BED (CULV. OUTL.) (1) EL. 2.5' MSL TO TOP OF DAM EL. 28.1' MSL (24.3' MHW)
 $H = 25'$. \odot CULVERT INLET FROM "AS BUILT" DINGS, SLOPE (13%) AND CULV. LENGTH = 115'

(ii) HAZARD POTENTIAL: LAKE SUTTONSTALL IS LOCATED JUST $\frac{1}{4}$ ($\approx 500'$) FROM SEVERAL LOW HOUSES AND OTHER STRUCTURES (TROLLEY MUSEUM) ALONG THE FARM RIVER. FURTHER $\frac{3}{4}$ (≈ 1 MI), AFTER PASSING SOME MARSH LAND, THERE IS ALONG THE FARM RIVER NEAR SHORT BEACH ROAD, ANOTHER URBAN AREA WITH HOUSES RELATIVELY LOW ABOVE THE STREAM BED.

*NOTE: NEW HAVEN WATER CO. DATUM (CALLED MEAN HIGH WATER - MHW) IS, FOR THIS PARTICULAR DAM, 2.83' (NOT 3.31') ABOVE USGS MSL DATUM. (S. FIORI/N.H.W.C. TO G. STEPHENS/CE, ON 6/6/79)
 THEREFORE, \therefore USGS DATUM (MSL) = NEW HAVEN DATUM (MHW) + 2.83' (USE + 2.8')

NON-FEDERAL DAMS INSPECTION

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LAKE SALTONSTALL DAM

2.9 - Cont'd) CLASSIFICATION OF DAM ACCORDING TO NED-ACE GUIDELINES

(iii) CLASSIFICATION:

SIZE: INTERMEDIATE

HAZARD: HIGH

b) $SDF = PMF = 7450 \text{ cfs}$ $\frac{1}{2} PMF = 3700 \text{ cfs}$

3) SURCHARGE AT PEAK INFLOW

a) PEAK INFLOW: $Q_p = 7450 \text{ cfs}$ $Q_p' = \frac{1}{2} PMF = 3700 \text{ cfs}$

b) SPILLWAY (OUTFLOW) RATING CURVE

c) SPILLWAY:

THE OUTLET STRUCTURE OF LAKE SALTONSTALL DAM IS A CONDUIT SPILLWAY WITH INCLINED 10' WIDE X (±) 4.2' HIGH RECTANGULAR ENTRANCE DISCHARGING INTO A 58" X 36" CORRUGATED METAL PIPE ARCH CONDUIT (±) 115' LONG, LAID ON A 13% SLOPE. THE ENTRANCE HAS A COARSE BAR SCREEN. (SEE SKETCH ON NEXT PAGE) THE SPILLWAY CREST (ENTRANCE INVERT) IS AT ELEV. 22.1' MSL (19.3' MHH). THE PIPE ARCH INVERT AT THE ENTRANCE IS AT ELEV. 17.4' MSL AND AT THE OUTLET IS AT ELEV. (±) 2.5' MSL.

THEREFORE, THE CONDUIT SPILLWAY COULD OPERATE AS A SPILLWAY OVER THE CREST OF THE CONDUIT ENTRANCE (FREE OR SUBMERGED) OR AS FULL CONDUIT, WHEN THE ENTRANCE BECOMES TOTALLY SUBMERGED. OTHER TYPES OF FLOW THAT MAY PREVAIL UNDER CERTAIN CONDITIONS ARE ORIFICE FLOW (INLET CONTROL) AND SLUG (TRANSITIONAL) FLOW.

NON-FEDERAL DAMS INSPECTION

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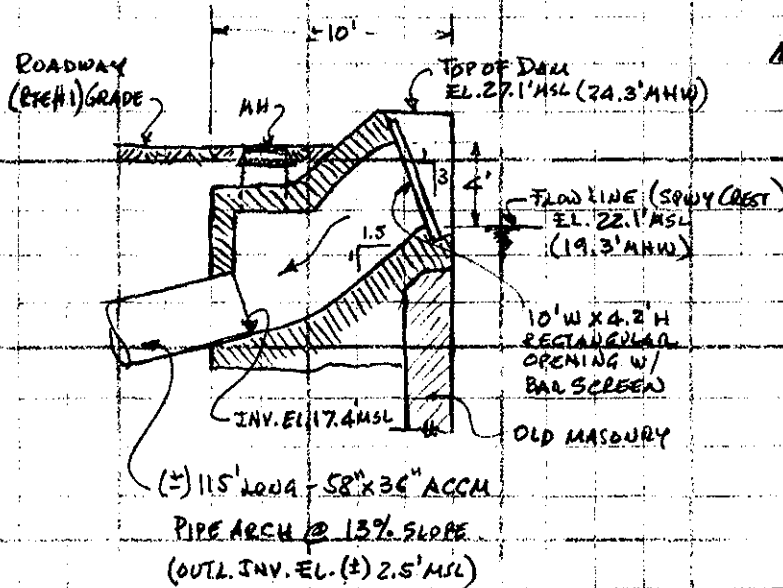
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LAKE SAKTONSTALL DAM

3.6.i-Cont'd) OVERFLOW RATING CURVE - SPILLWAY



NOTE: DATA FROM NHWC No. 90133

"AS BUILT" DRAWINGS OF LAKE

SAKTONSTALL SPILLWAY BY C. B. BIRD

ASSOC. DATED DEC. 1960, AND C.E.

FIELD SURVEY AND OBSERVATIONS.

ASSUME ACQM PIPE $n = 0.024$

ENTRANCE TO PIPE $K_E = 0.5$

ENTRANCE AT SPILLWAY (FULL) $K_E = 0.5$

ASSUME SPILLWAY $C = 3.0$

THIS COEFFICIENT IS ASSUMED TO ACCOUNT FOR FACTORS EF-

FECTING THE FLOW AT THE SPWY.

ENTRANCE LIKE SIDE CONTRACTIONS, BAR SCREEN INTERFERENCE (ASSUMED CLEAN), ETC.; ALSO, ASSUME SPWY. EFFECTIVE LENGTH $L = 0.8 \times 10 = 8'$

PULSATING (SLUG) FLOW AND OTHER PHENOMENA WHICH MAY OCCUR AT CERTAIN FLOW CONDITIONS IN THIS TYPE OF SPILLWAYS, WILL NOT BE INVESTIGATED. ALSO, IT WILL BE ASSUMED THE CONDUIT FLOWING FULL AND TAILWATER APPROX. TO THE CROWN OF THE CONDUIT AT THE OUTLET (I.E., CONDUIT OUTLET CONTROL) ALTHOUGH INLET CONTROL AT THE ARCH PIPE MAY EXIST FOR SOME FLOWS (DIFF. WILL BE SMALL IN THIS CASE). THEREFORE, THE U.S. AT THE INLET, DEPENDING ON THE FLOW COULD BE ESTABLISHED BY: a) SPILLWAY DISCHARGE (FREE) FOR FLOWS AT WHICH THE CONDUIT HEADWATER IS AT OR BELOW ELEV. 22.1' MSL; b) SPILLWAY/PIPE DISCHARGE (SPILLW. SUBMERGED) FOR FLOWS AT WHICH THE CONDUIT HEADWATER IS ABOVE (±) EL. 22.1' MSL AND BELOW (±) ELEV. 27' MSL (SAY (±) $1.2 \times 4 = 4.8'$ ABOVE SPWY CREST.); AND,

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LARGO SALTONSTALL DAM

3.6.0-Cont'd) OVERFLOW RATING CURVE - SPILLWAY

c) CONDUIT FLOW FOR FLOWS THAT SUBMERGE THE ENTRANCE (AT THE SPILLWAY) ABOVE (*) EL. 22' MSG NEAR THE TOP OF THE DAM.

USING THE CONDUIT SPILLWAY ENTRANCE INVERT (SPILL CREST) ELEVATION AS DATUM, THE SPILLWAY DISCHARGE UNSUBMERGED IS APPROXIMATED BY:

$$Q_{s,u} = 24 H^{3/2} \therefore H = \left(\frac{Q_{s,u}}{24} \right)^{2/3} \quad (L=8'; C=3.0)$$

THE HEADWATER ELEVATION FOR THE ARCH PIPE-ARCH, REFERRED TO THE SAME DATUM CAN BE APPROXIMATED BY:

$$H_0 = H - H_L = \left(\frac{1+K_0}{25A^2} + \frac{L}{K^2} \right) Q^2 - H_L \quad (\text{FULL FLOW})$$

WHERE, $H_L = 22.1 - (2.5 + 3) = 16.6'$ IS THE DIFFERENCE IN ELEVATIONS BETWEEN THE SPILLWAY CREST AND THE ASSUMED TD ELEVATION

THE FULL 58" x 36" PIPE ARCH GEOMETRIC PARAMETERS ARE:

$$A_0 = 11.4 \text{ SQ FT} \quad R = 0.907' \therefore K_{24} = 663 \quad L = 115'$$

THEREFORE, FOR THE CONDUIT, THE RATING CURVE CAN BE APPROXIMATED BY:

$$H_0 = 4.41 \times 10^{-4} Q_{s_2}^2 - 16.6 \therefore Q_{s_2} = 47.6 (H + 16.6)^{1/2}$$

H_0 COULD BE POSITIVE OR NEGATIVE DEPENDING ON WHETHER THE SPILLWAY CREST IS SUBMERGED OR NOT BY THE PIPE-ARCH HEADWATER.

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LAKE SALTONSTALL DAM

3, 6, 6 - Cont'd) OVERFLOW RATING CURVE - SPILLWAY

IF THE WATER DEPTH AT THE ENTRANCE IS (\pm) 4.8' ABOVE THE SPILLWAY CREST (~ 1.20) THE INLET STRUCTURE BECOMES FULL AND WILL BE ASSUMED AS AN EXTENSION OF THE PIPE ARCH WITH NEGLIGIBLE FRICTION LOSS BUT AN ADDITIONAL ENTRANCE LOSS; THEREFORE, CHANGING SLIGHTLY THE RATING CURVE EQUATION TO:

$$H_c = 4.67 \times 10^{-6} Q_3^2 - 16.6 \quad \therefore \quad Q_3 = 46.9 (H + 16.6)^{1/2} \quad (247)$$

THEREFORE, THE SPILLWAY SUBMERGENCE WILL START AT AN OUTFLOW OF (\pm) 194 CFS CORRESPONDING TO A SURCHARGE OF:

$$H_u = \left(\frac{194}{24} \right)^{2/5} = 4.0' \text{ OR, } (\pm) \text{ AT FULL OPENING}$$

SPILLWAY CAPACITY WITHIN THE SUBMERGED RANGE CAN BE APPROXIMATED BY THE VILLEMONT'S EQUATION:

$$\frac{Q}{Q_1} = \left[1 - \left(\frac{H_2}{H_1} \right)^{1/5} \right]^{0.385} \quad \text{OR} \quad \frac{Q_2}{Q_1} + \left(\frac{Q}{Q_1} \right)^{2.60} = 1$$

WHERE Q_1 AND Q_2 ARE FREE FLOW DISCHARGES UNDER THE HEADS H_1 AND H_2 ($1/5$ AND $2/5$ FROM THE SPILLWAY) AND Q IS THE ACTUAL FLOW FOR THE SUBMERGED CONDITION.

HOWEVER, THE TRANSITION TO FULL FLOW AT THE ENTRANCE OCCURS AT A HEAD SLIGHTLY HIGHER AND THEREFORE THE SUBMERGED RANGE WILL BE SUFFICIENTLY APPROXIMATED BY POINTS GIVEN BY THE RATING CURVE GIVEN ABOVE FOR $H \geq 4.8'$ (FULL INLET STRUCTURE).

IN GENERAL, SHOULD INLET CONTROL PREVAIL AT THE PIPE ARCH ENTRANCE, THE CONDUIT SPILLWAY CAPACITY WOULD BE REDUCED BY UP TO 54% (\pm) 25%.

NON-FEDERAL DAMS INSPECTION

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LAKE SALTONSTALL DAM

3.6 - Cont'd) OUTFLOW RATING CURVE

(i) EXTENSION OF THE RATING CURVE FOR SURCHARGE HEADS ABOVE TOP OF DAM.

THE DAM IS AN EARTH EMBANKMENT WITH STONE FACING ON THE US SIDE. THE EMBANKMENT IS NOW INCORPORATED IN THE HIGHWAY EMBANKMENT OF U.S. RTE. #1. THE MASONRY FACING OF THE DAM WAS CAPPED WITH CONCRETE TO ⁽⁺⁾ELEV. 27.1' MSL (24.3' MHHW). THE LENGTH IS $(\pm) 92'$ (FROM NHWC. AVAILABLE DATA).

THE TOP OF THE DAM, HIGHWAY AND SIDE SLOPES FORM AN OVERFLOW PROFILE $(\pm) 225'$ LONG AT ELEV. 27.1' MSL (\pm) , FLANKED BY SLOPING TERRAIN ON $(\pm) 6"$ TO $1'$ TO THE RIGHT AND $(\pm) 3.5"$ TO $1'$ TO THE LEFT. THE APPROX. BREADTH OF THIS OVERFLOW SECTION IS $(\pm) 75'$.

ASSUME $C=2.7$ FOR THE OVERFLOW SECTION. THIS DISCHARGE COEFFICIENT IS ASSUMED TO ACCOUNT FOR THE TOP BROADNESS; ROUGHNESS OF THE SIDE SLOPES; FENCE/RAILING OVER PORTIONS OF THE DAM; HIGHWAY DIVIDE; ETC.

ASSUME ALSO, AN EQUIVALENT LENGTH FOR THE SLOPING TERRAIN AT BOTH SIDES OF THE DAM (AND CORRESPONDING DISCHARGE) GIVEN BY:

$$\text{LEFT SIDE: } L'_L = \frac{2}{3} \left(\frac{3.5}{1} \right) (H-5) = 2.33(H-5) \quad \left. \begin{array}{l} \\ \end{array} \right\} \quad L'_R = 6.33(H-5)$$

$$\text{RIGHT SIDE: } L'_R = \frac{2}{3} \left(\frac{6}{1} \right) (H-5) = 4.0(H-5) \quad \left. \begin{array}{l} \\ \end{array} \right\} \quad Q_{L,R} = 17.1(H-5)^{5/2}$$

NON-FEDERAL DAMS INSPECTION

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LAKE SACONSTALL DAM

3.6. (i-Cont'd) OUTFLOW RATING CURVE

THEREFORE THE TOTAL OVERFLOW MAY BE APPROXIMATED BY THE FORMULA:

$$Q = Q_s + Q_d + Q_{dr} = Q_s + 2.7 \times 225 (H-5)^{3/2} + 17 (H-5)^{5/2}$$

(N 610)

WHERE Q_s IS THE CONDUIT SPILLWAY FLOW GIVEN BY THE FORMULA:

$$Q_s = 47 (H + 16.6)^{1/2} \quad (\text{CONDUIT FULL / SUBMERGED - SEE P. 8 OF THESE COMPS.})$$

OR: $Q_s = 47 (H + 16.6)^{1/2} + 610 (H-5)^{3/2} + 17 (H-5)^{5/2}$

FOR $H \geq 4.8'$

THE OUTFLOW RATING CURVE IS PLOTTED ON NEXT PAGE.

C) SPILLWAY CAPACITY* TO TOP OF EMBANKMENT (EL. 27.1 ^{MSL} \approx 24.3 ^{MHW})

$H = 5' \therefore Q_s = 220 \text{ cfs}$ ($\pm 3.0\%$ OF Q_p ; ($\pm 6.0\%$ OF Q_p')

D) SURCHARGE HEIGHT TO PASS (Q_p):

i) @ $Q_p = PMF = 7450 \text{ cfs}$ $H_s \approx 9.8'$

ii) @ $Q_p' = 1/2 PMF = 3700 \text{ cfs}$ $H_s' \approx 8.0'$

*NOTE: IT IS CONCEIVABLE THAT EXTREME HIGH TIDES MAY SUBSTANTIALLY REDUCE THE DISCHARGE CAPACITY OF THE CONDUIT OUTLET.

NON-FEDERAL DAMS INSPECTION

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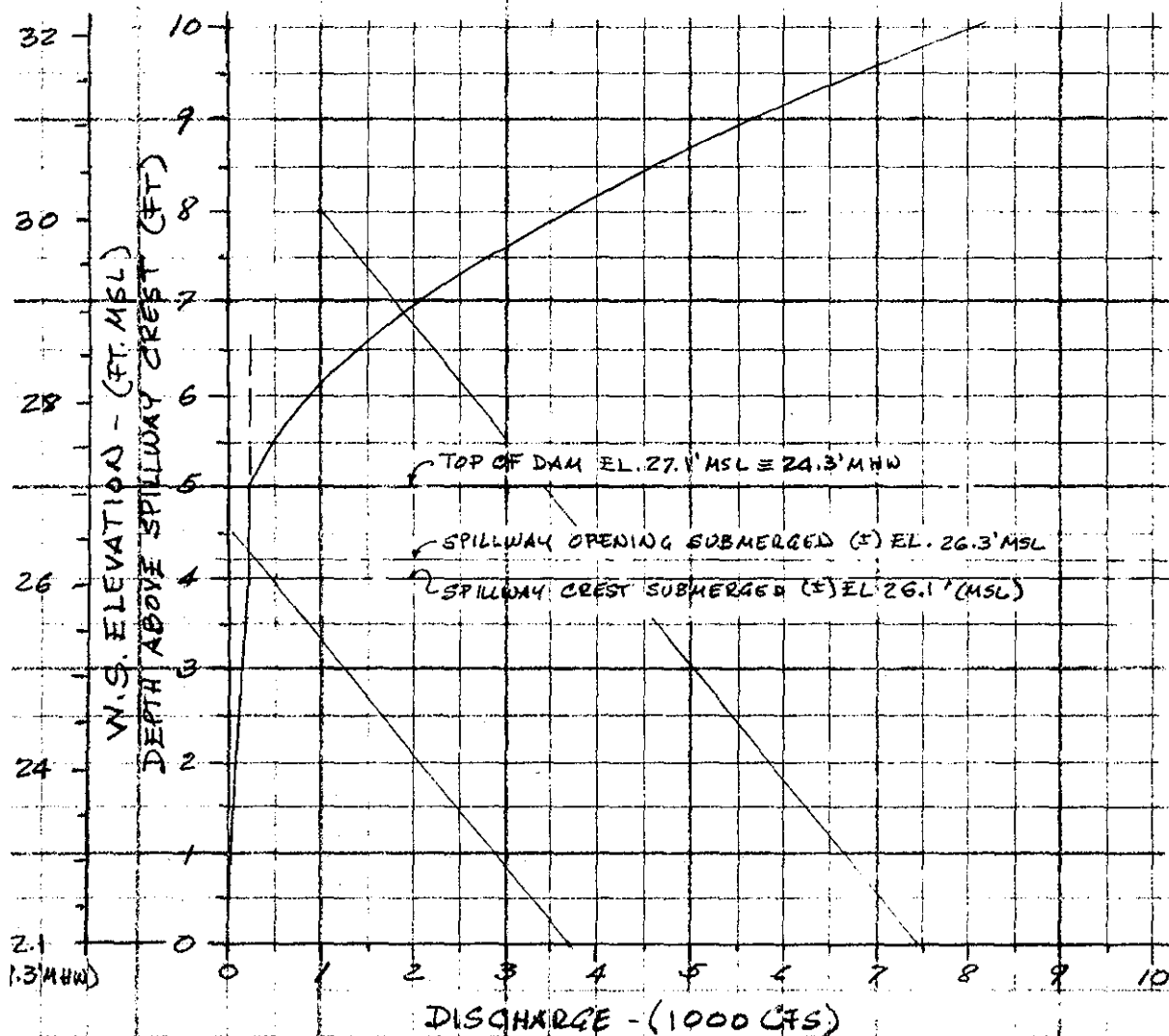
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LAKE SALTONSTALL DAM

3- (Cont'd) OUTFLOW RATING CURVE



⊗ SEE NOTE P. 4 OF THESE COMPUTATIONS.

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LAKE SALTONSTALL DAM

4) EFFECT OF SURCHARGE ON MAXIMUM PROBABLE DISCHARGES (OUTFLOW)

a) RESERVOIR (LAKE) AREA @ FLOW LINE: $*A \approx 388 \text{ AC}$

\therefore ASSUME AVE. LAKE AREA WITHIN EXPECTED SURCHARGE $*\bar{A} \approx 430 \text{ AC}$

*SEE "STORAGE" P. 4 OF THESE COMPUTATIONS

b) ASSUME NORMAL POOL LEVEL (\pm) AT SPILLWAY CREST (EL. 22.1' MSL)

c) WATERSHED AREA: D.A. = 3.92 sq mi (SEE P. 2 OF THESE COMPS.)

d) DISCHARGE (Q_P) AT VARIOUS HYPOTHETICAL SURCHARGE ELEVATIONS:

$$H = 8' \quad V = 430 \times 8 = 3440 \text{ AC-FT} \quad \therefore S = \frac{3440}{3.92 \times 53.3} = 16.46''$$

$$H = 3' \quad V = 1290 \text{ AC-FT} \quad \therefore S = 6.17''$$

\therefore FROM APPROXIMATE STORAGE ROUTING NED-ACE GUIDELINES (19" MAX. PROBABLE R.O. IN NEW ENGLAND):

$$Q_{P2} = Q_{P1} \left(1 - \frac{S}{19}\right) \quad \text{AND FOR } 1/2 \text{ PMF: } Q'_{P2} = Q'_{P1} \left(1 - \frac{S}{19}\right)$$

\therefore FOR THE PREVIOUS HYPOTHETICAL SURCHARGES:

$$H = 9' \quad Q_{P2} = 994 \text{ CFS}$$

$$H = 3' \quad Q_{P2} = 5030 \text{ CFS} \quad Q'_{P2} = 1295 \text{ CFS}$$

$$\text{ALSO, FOR } H = 0; \quad Q_{P2} = 7450 \text{ CFS} \quad \text{AND} \quad Q'_{P2} = 3700 \text{ CFS}$$

NON-FEDERAL DAMS INSPECTION

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LAKE SACTAWASTOCK DAM

4-CON'D) EFFECT OF SURCHARGE STORAGE ON PEAK OUTFLOW:

e) PEAK OUTFLOW (Q_B):

USING NED-ACE GUIDELINES "SURCHARGE STORAGE ROUTING" ALTERNATE METHOD (SEE P. 11 OF THESE COMPUTATIONS):

$$Q_B \approx 1900 \text{ CFS} \quad H_B \approx 6.9' \text{ FOR } Q_P = \text{PMF}$$

$$Q'_B \approx 200 \text{ CFS} \quad H'_B \approx 4.4' \text{ FOR } Q'_P = \frac{1}{2} \text{ PMF}$$

f) SPILLWAY CAPACITY RATIO TO OUTFLOW:

SPILLWAY CAPACITY TO TOP OF DAM: $Q_S \approx 220 \text{ CFS}$ (SEE P. 10)

\therefore SPILLWAY CAPACITY IS (±) 12% THE OUTFLOW AT PMF AND (±) 110% THE OUTFLOW AT $\frac{1}{2}$ PMF

5) SUMMARY

- a) PEAK INFLOW: $Q_P = \text{PMF} \approx 7450 \text{ CFS}$ $Q'_P = \frac{1}{2} \text{ PMF} \approx 3700 \text{ CFS}$
 b) PEAK OUTFLOW: $Q_B \approx 1900 \text{ CFS}$ $Q'_B \approx 200 \text{ CFS}$
 c) SPILLWAY MAX. CAPACITY: $Q_S \approx 220 \text{ CFS}$ OR (±) 12% OF Q_B ; (±) 110% OF Q'_B

THEREFORE, AT SDF = PMF, THE DAM IS OVERTOPPED (±) 1.9' (W.S. EL. 29' MSL \approx 26.2' MHW) OR, TO A SURCHARGE OF (±) 6.9' ABOVE THE FLOWLINE (SPILLWAY CREST ELEV. 22.1' MSL \approx 19.3' MHW).

AT A TEST FLOOD $Q'_P = \frac{1}{2} \text{ PMF}$, THE SPILLWAY MAY PASS THE FULL OUTFLOW WITH A THEORETICAL FREEBOARD OF (±) 0.6' (W.S. EL. 26.5' MSL \approx 23.7' MHW).

HOWEVER, BECAUSE OF PERFORMANCE CHARACTERISTICS OF THE CONDUIT SPILLWAY, ITS CAPACITY AND, CONSEQUENTLY, THE FREEBOARD MAY BE REDUCED CONSIDERABLY.

NON-FEDERAL DAMS INSPECTION

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LAKE SALTONSTALL DAM

II) DOWNSTREAM FAILURE HAZARD

1) PEAK FLOOD AND STAGE IMMEDIATELY $\frac{1}{2}$ FROM DAM:

a) BREACH WIDTH:

i) MID-HEIGHT (+) ELEV. 14.6' MSL (11.8' MHW) $(27.1 - \frac{25}{2} = 14.6' \text{ MSL})$

* SEE "HEIGHT" P. 4 OF THESE COMPS.

ii) APPROX. MID-HEIGHT LENGTH: $L = 140'$ (+) FROM C.E. INSPECTION MAP

iii) BREACH WIDTH (SEE NEO-ACE $\frac{1}{2}$ DAM FAILURE GUIDELINES):

$$W = 0.4 \times 140 = 56' \therefore \text{ASSUME } W_b = \underline{56'}$$

b) PEAK FAILURE OUTFLOW (Q_p):

ASSUME SURCHARGE TO TOP OF DAM (EL. 27.1' MSL); THEREFORE,

i) HEIGHT AT TIME OF FAILURE: $Y_o = 25'$

ii) SPILLWAY DISCHARGE: $Q_s = 220 \text{ CFS}$

iii) BREACH OUTFLOW (Q_b):

$$Q_b = \frac{8}{27} W_b \sqrt{g} Y_o^{3/2} = 11800 \text{ CFS}$$

iv) PEAK FAILURE OUTFLOW (Q_p): $Q_p = Q_s + Q_b = \underline{12000 \text{ CFS}}$

c) FLOOD DEPTH IMMEDIATELY $\frac{1}{2}$ FROM DAM:

$$Y_o = 0.44 Y_p = \underline{11'}$$

NON-FEDERAL DAMS INSPECTION

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LAKE SACTON STALL DAM

1-Cont'd) PEAK FLOOD AND STAGE IMMEDIATELY $\frac{1}{2}$ FROM DAM

d) APPROXIMATE STAGE JUST BEFORE FAILURE:

i) $Q = Q_s \approx 220 \text{ cfs}$

ii) CHANNEL $\frac{1}{2}$ FROM DAM:

THE CHANNEL IS A VERY FLAT ($S \approx 0.02\%$) GRASSY CHANNEL WITH (\pm) $40'' : 1'$ AND $50'' : 1'$ SIDE SLOPES TO A DEPTH OF (\pm) $2.5'$

\therefore iii) STAGE: @ $Q = 220 \text{ cfs}$ $y_n \approx 2.3'$ ($n \approx 0.025$)

e) RAISE IN STAGE AFTER FAILURE: $\Delta y \approx 11 - 2.3 \approx \underline{\underline{8.7'}}$

2) SUMMARY

a) PEAK FAILURE OUTFLOW: $Q_p \approx 12000 \text{ cfs}$

b) FLOOD DEPTH IMMEDIATELY $\frac{1}{2}$ FROM DAM: $y \approx 11'$

c) APPROXIMATE STAGE BEFORE FAILURE: $y_n \approx 2.3'$

d) RAISE IN STAGE AFTER FAILURE: $\Delta y \approx 8.7'$

**PRELIMINARY GUIDANCE
FOR ESTIMATING
MAXIMUM PROBABLE DISCHARGES
IN
PHASE I DAM SAFETY
INVESTIGATIONS**

**New England Division
Corps of Engineers**

March 1978

MAXIMUM PROBABLE FLOOD INFLOWS
NED RESERVOIRS

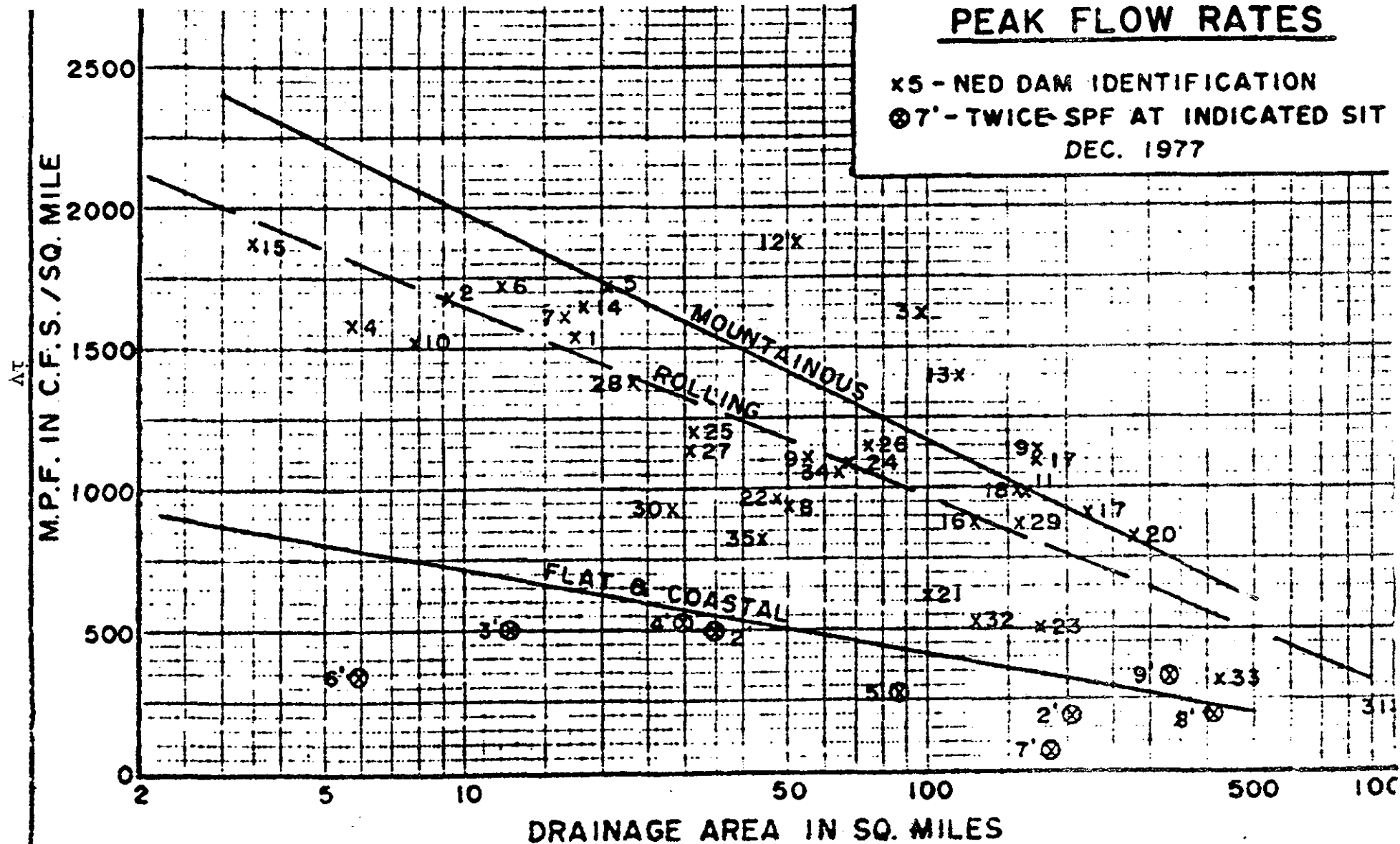
<u>Project</u>	<u>Q</u> (cfs)	<u>D.A.</u> (sq. mi.)	<u>MPF</u> cfs/sq. mi.
Hall Meadow Brook	26,600	17.2	1,546
East Branch	15,500	9.25	1,675
Thomaston	158,000	97.2	1,625
Northfield Brook	9,000	5.7	1,580
Black Rock	35,000	20.4	1,715
Mancock Brook	20,700	12.0	1,725
Hop Brook	26,400	16.4	1,610
Tully	47,000	50.0	940
Barre Falls	61,000	55.0	1,109
Conant Brook	11,900	7.8	1,525
Knightville	160,000	162.0	987
Littleville	98,000	52.3	1,870
Colebrook River	165,000	118.0	1,400
Mad River	30,000	18.2	1,650
Sucker Brook	6,500	3.43	1,895
Union Village	110,000	126.0	873
North Hartland	199,000	220.0	904
North Springfield	157,000	158.0	994
Ball Mountain	190,000	172.0	1,105
Townshend	228,000	106.0(278 total)	820
Surry Mountain	63,000	100.0	630
Otter Brook	45,000	47.0	957
Birch Hill	88,500	175.0	505
East Brimfield	73,900	67.5	1,095
Westville	38,400	99.5(32 net)	1,200
West Thompson	85,000	173.5(74 net)	1,150
Hodges Village	35,600	31.1	1,145
Buffumville	36,500	26.5	1,377
Mansfield Hollow	125,000	159.0	786
West Hill	26,000	28.0	928
Franklin Falls	210,000	1000.0	210
Blackwater	66,500	128.0	520
Hopkinton	135,000	426.0	316
Everett	68,000	64.0	1,062
MacDowell	36,300	44.0	825

MAXIMUM PROBABLE FLOWS
BASED ON TWICE THE
STANDARD PROJECT FLOOD
(Flat and Coastal Areas)

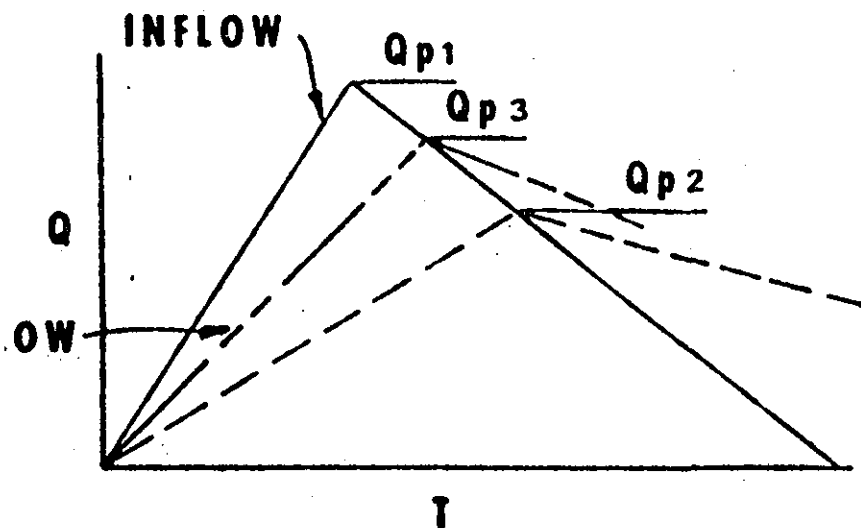
<u>River</u>	<u>SPF</u> (cfs)	<u>D.A.</u> (sq. mi.)	<u>MPF</u> (cfs/sq. mi.)
1. Pawtuxet River	19,000	200	190
2. Mill River (R.I.)	8,500	34	500
3. Peters River (R.I.)	3,200	13	490
4. Kettle Brook	8,000	30	530
5. Sudbury River.	11,700	86	270
6. Indian Brook (Hopk.)	1,000	5.9	340
7. Charles River.	6,000	184	65
8. Blackstone River.	43,000	416	200
9. Quinebaug River	55,000	331	330

PEAK FLOW RATES

x5 - NED DAM IDENTIFICATION
 ⊗ 7' - TWICE SPF AT INDICATED SIT
 DEC. 1977



ESTIMATING EFFECT OF SURCHARGE STORAGE ON MAXIMUM PROBABLE DISCHARGES



STEP 1: Determine Peak Inflow (Q_{p1}) from Guide Curves.

STEP 2: a. Determine Surcharge Height To Pass " Q_{p1} ".

b. Determine Volume of Surcharge ($STOR_1$) In Inches of Runoff.

c. Maximum Probable Flood Runoff In New England equals Approx. 19", Therefore

$$Q_{p2} = Q_{p1} \times \left(1 - \frac{STOR_1}{19}\right)$$

STEP 3: a. Determine Surcharge Height and " $STOR_2$ " To Pass " Q_{p2} "

b. Average " $STOR_1$ " and " $STOR_2$ " and Determine Average Surcharge and Resulting Peak Outflow " Q_{p3} ".

SURCHARGE STORAGE ROUTING SUPPLEMENT

TEP 3: a. Determine Surcharge Height and
"STOR₂" To Pass "Q_{p2}"

b. Avg "STOR₁" and "STOR₂" and
Compute "Q_{p3}".

c. If Surcharge Height for Q_{p3} and
"STOR_{AVG}" agree O.K. If Not:

TEP 4: a. Determine Surcharge Height and
"STOR₃" To Pass "Q_{p3}"

b. Avg. "Old STOR_{AVG}" and "STOR₃"
and Compute "Q_{p4}"

c. Surcharge Height for Q_{p4} and
"New STOR_{AVG}" should Agree
closely

SURCHARGE STORAGE ROUTING ALTERNATE

$$Q_{p2} = Q_{p1} \times \left(1 - \frac{\text{STOR}}{19} \right)$$

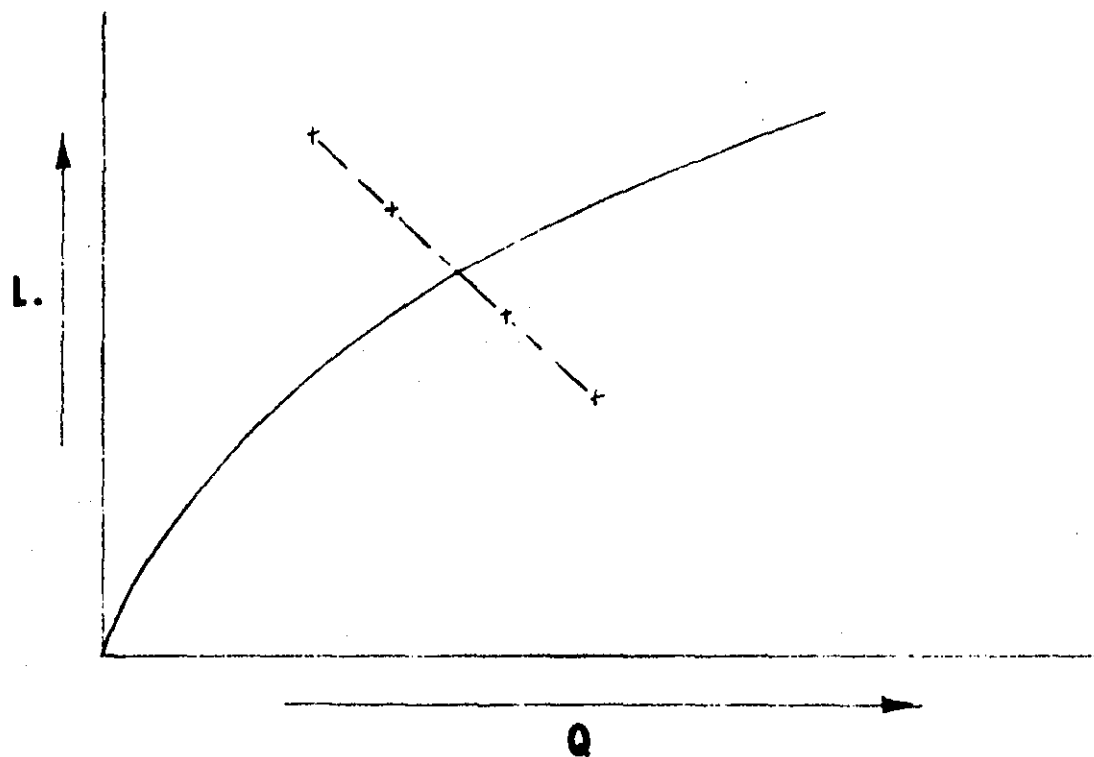
$$Q_{p2} = Q_{p1} - Q_{p1} \left(\frac{\text{STOR}}{19} \right)$$

FOR KNOWN Q_{p1} AND 19" R.O.

Q_{p2}

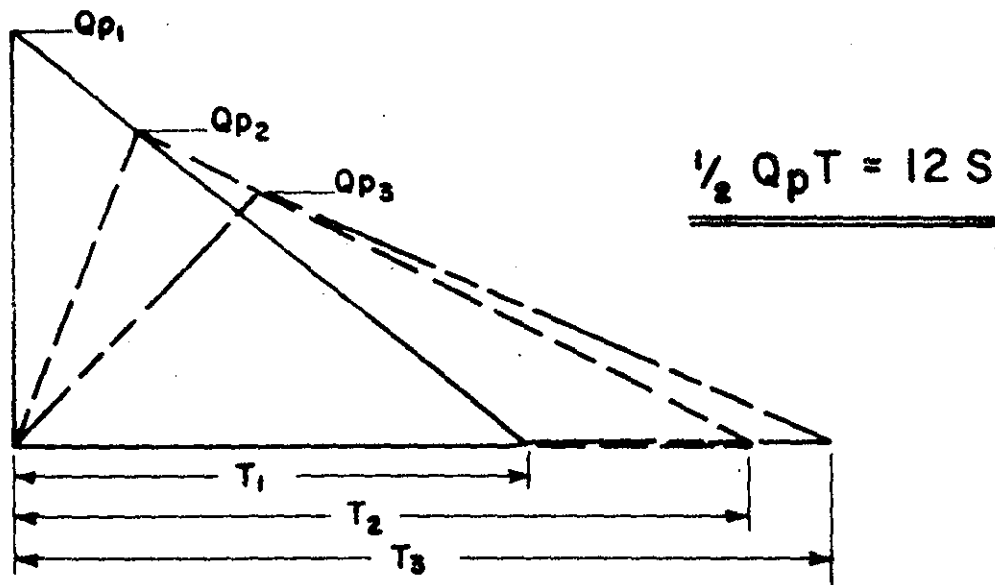
STOR

EL.



Q

RULE OF THUMB" GUIDANCE FOR ESTIMATING DOWNSTREAM DAM FAILURE HYDROGRAPHS



STEP 1: DETERMINE OR ESTIMATE RESERVOIR STORAGE (S) IN AC-FT AT TIME OF FAILURE.

STEP 2: DETERMINE PEAK FAILURE OUTFLOW (Q_{p1}).

$$Q_{p1} = \frac{8}{27} w_b \sqrt{g} Y_0^{3/2}$$

w_b = BREACH WIDTH - SUGGEST VALUE NOT GREATER THAN 40% OF DAM LENGTH ACROSS RIVER AT MID HEIGHT.

Y_0 = TOTAL HEIGHT FROM RIVER BED TO POOL LEVEL AT FAILURE.

STEP 3: USING USGS TOPO OR OTHER DATA, DEVELOP REPRESENTATIVE STAGE-DISCHARGE RATING FOR SELECTED DOWNSTREAM RIVER REACH.

STEP 4: ESTIMATE REACH OUTFLOW (Q_{p2}) USING FOLLOWING ITERATION.

A. APPLY Q_{p1} TO STAGE RATING, DETERMINE STAGE AND ACCOMPANYING VOLUME (V_1) IN REACH IN AC-FT. (NOTE: IF V_1 EXCEEDS $1/2$ OF S, SELECT SHORTER REACH.)

B. DETERMINE TRIAL Q_{p2} .

$$Q_{p2}(\text{TRIAL}) = Q_{p1} \left(1 - \frac{V_1}{S}\right)$$

C. COMPUTE V_2 USING Q_{p2} (TRIAL).

D. AVERAGE V_1 AND V_2 AND COMPUTE Q_{p2} .

$$Q_{p2} = Q_{p1} \left(1 - \frac{V_{\text{avg}}}{S}\right)$$

STEP 5: FOR SUCCEEDING REACHES REPEAT STEPS 3 AND 4.

APRIL 1978

APPENDIX E

INFORMATION AS CONTAINED IN
THE NATIONAL INVENTORY OF DAMS



INVENTORY OF DAMS IN THE UNITED STATES

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	
STATE	IDENTITY NUMBER	DIVISION	STATE	COUNTY	CONGR. DIST.	STATE	COUNTY	CONGR. DIST.	NAME	LATITUDE (NORTH)	LONGITUDE (WEST)	REPORT DATE DAY MO YR
CT	115	NED	CT	009	03				LAKE SALTONSTALL DAM	4116.9	7251.7	31AUG79

(13)	(14)
POPULAR NAME	NAME OF IMPOUNDMENT
	LAKE SALTONSTALL

(15)	(16)	(17)	(18)	(19)	(20)
REGION	BASIN	RIVER OR STREAM	NEAREST DOWNSTREAM CITY-TOWN-VILLAGE	DIST FROM DAM (MI.)	POPULATION
01	07	FARM RIVER-OFFSTREAM	EAST HAVEN	1	25100

(21)	(22)	(23)	(24)	(25)	(26)	(27)	(28)
TYPE OF DAM	YEAR COMPLETED	PURPOSES	STRUC. TYPAL HEIGHT (FT.)	HYDRAU. IC HEIGHT (FT.)	IMPOUNDING CAPACITIES		
					MAXIMUM (ACRE-FT.)	NORMAL (ACRE-FT.)	
REPGOT	1882	S	25	25	6900	4700	DIST OWN FED R PRV/FED SCS A VER/DATE
							NED N N N N

(29)
REMARKS
22-ADDITIONS TO ACCOMODATE HIGHWAY IN 1928 AND 1940'S 21-US MASONRY FACE

(30)	(31)	(32)	(33)	(34)	(35)	(36)	(37)	(38)	(39)	(40)	(41)	(42)	(43)	(44)	(45)
D/S HAS	SPILLWAY			MAXIMUM DISCHARGE (FT.)	VOLUME OF DAM (CY)	POWER CAPACITY		NAVIGATION LOCKS							
	CREST LENGTH	TYPE	WIDTH (FT.)			INSTALLED (MW)	PROPOSED (MW)	NO.	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)
1	100	U	10	220											

(46)	(47)	(48)
OWNER	ENGINEERING BY	CONSTRUCTION BY
NEW HAVEN WATER COMPANY	PHINEAS E BALL (1882)	NEW HAVEN WATER COMPANY

(49)	(50)	(51)	(52)
REGULATORY AGENCY			
DESIGN	CONSTRUCTION	OPERATION	MAINTENANCE
CT WATER RESOURCES	CT WATER RESOURCES	CT WATER RESOURCES	CT WATER RESOURCES

(53)	(54)	(55)
INSPECTION BY	INSPECTION DATE DAY MO YR	AUTHORITY FOR INSPECTION
CAHN ENGINEERS INC	02MAY79	PL 92-367

(56)
REMARKS
32-DISCHARGES TO 58X36 INCH ARCH CULVERT 47-CLARENCE BLAIR ASSOC (1949,60